

Use of Cloud Computing for scalable geospatial data processing and access

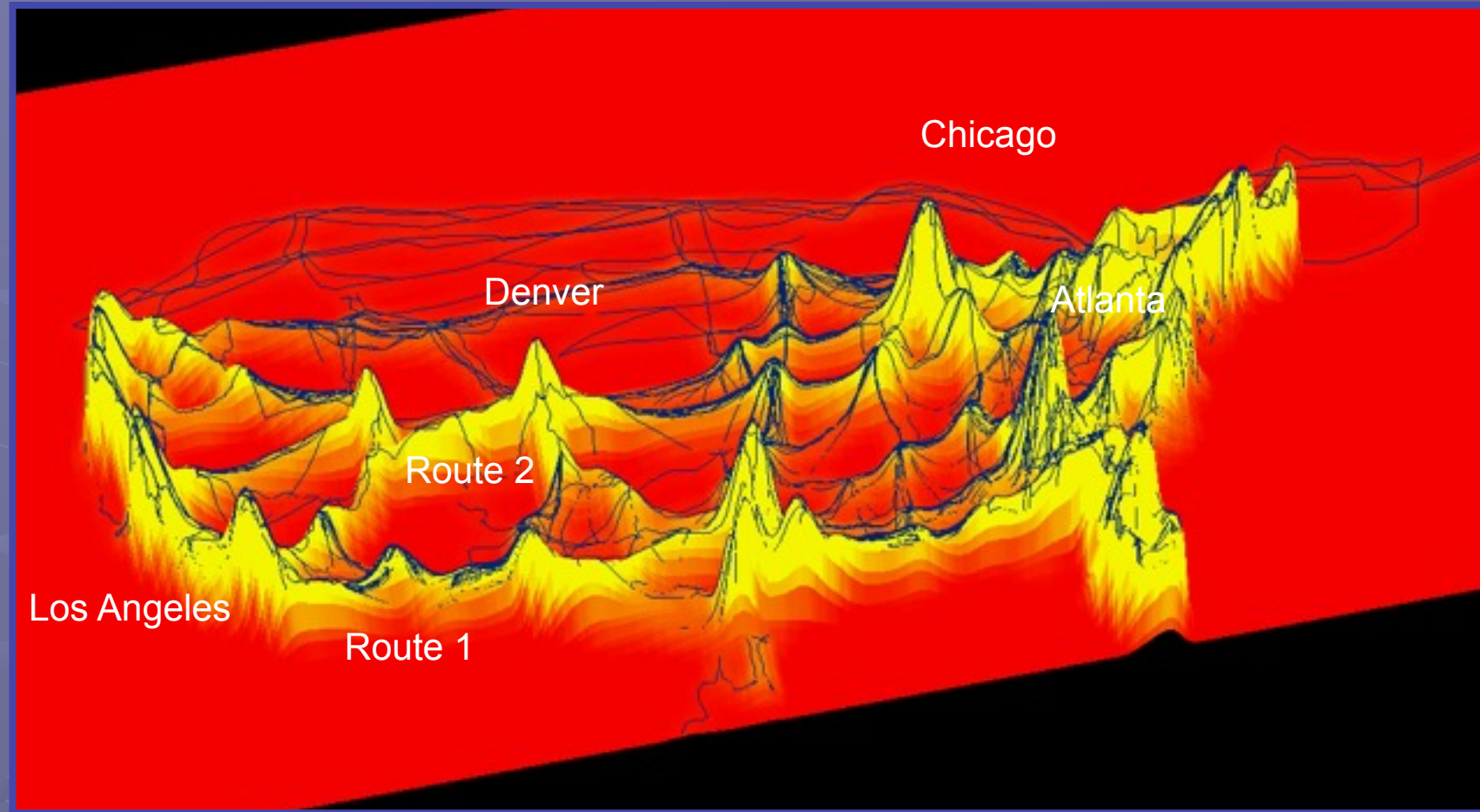
Andrew Turner
CTO, FortiusOne
andrew@fortiusone.com

Partner: U.S. Federal Geographic Data Committee

What is GeoCommons?

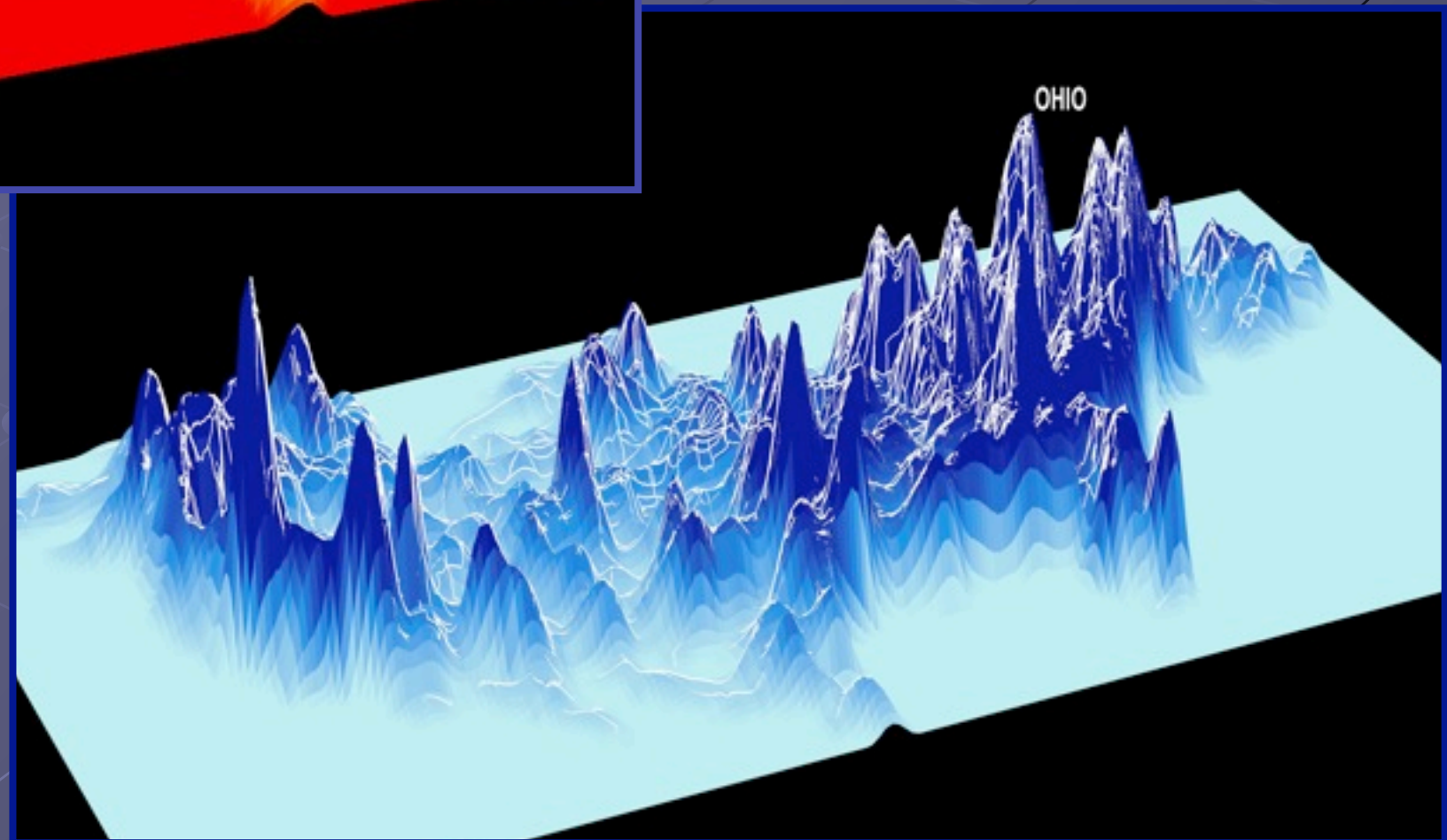
A Brief History

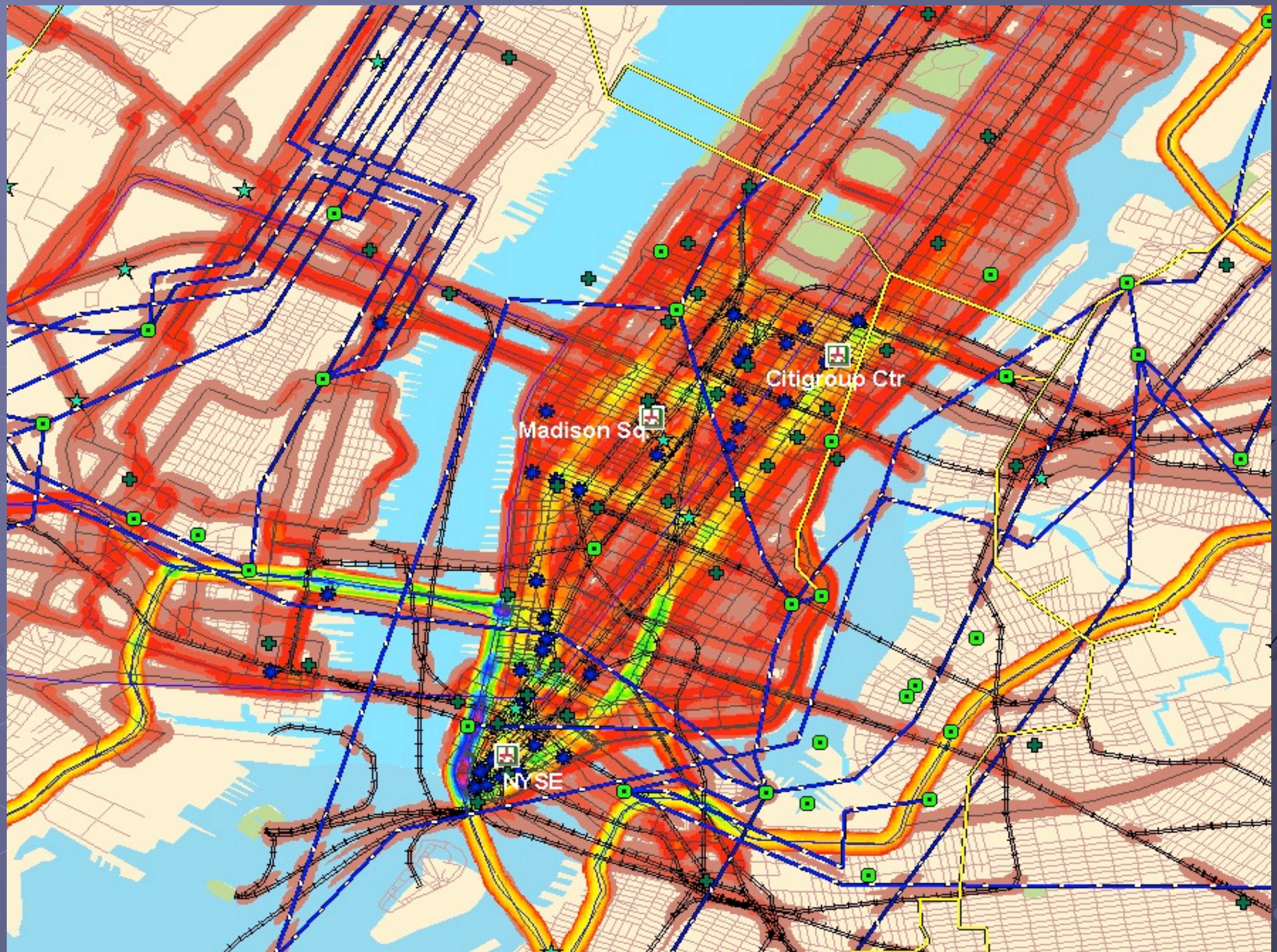
Vulnerability Identification

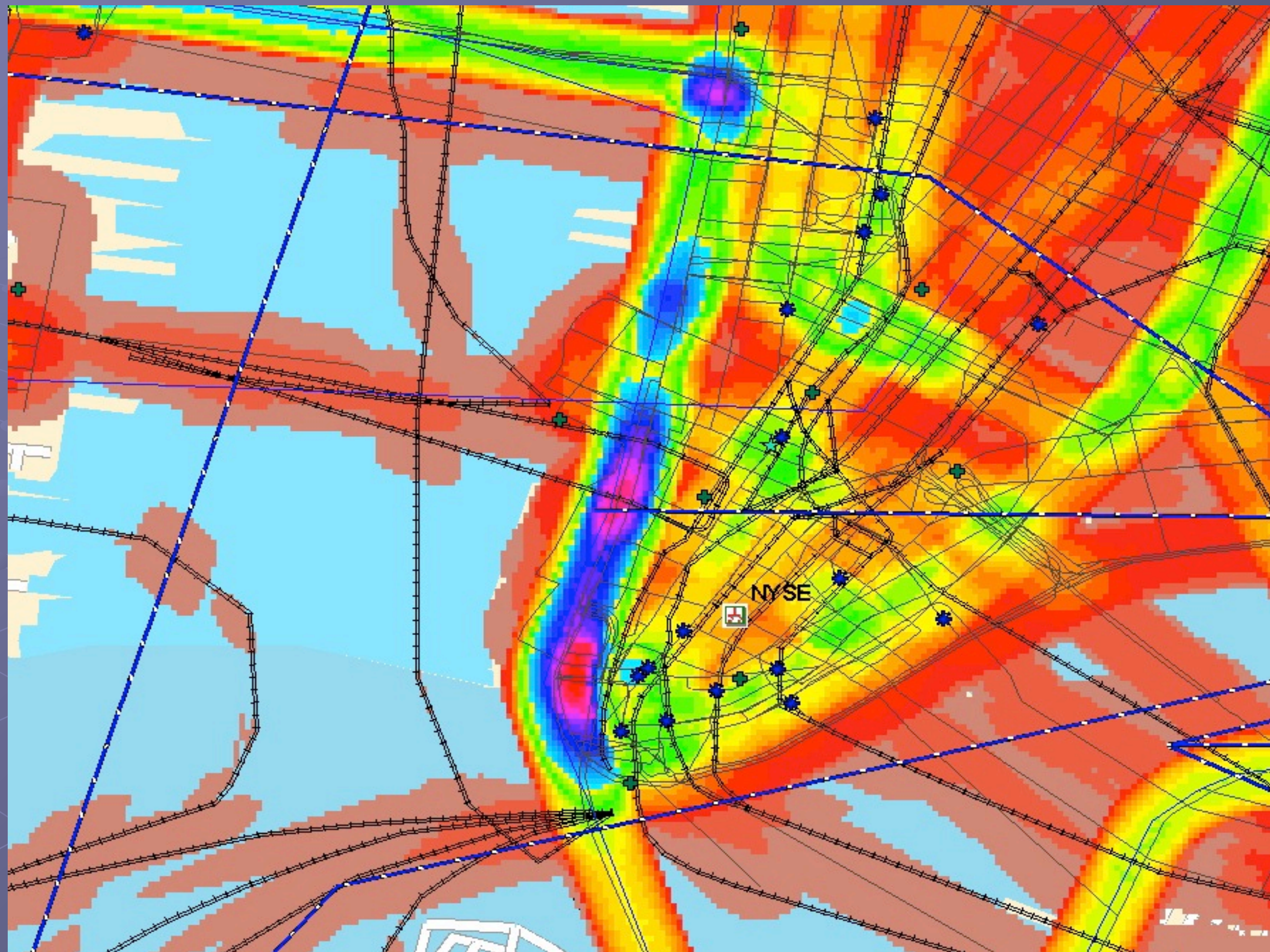


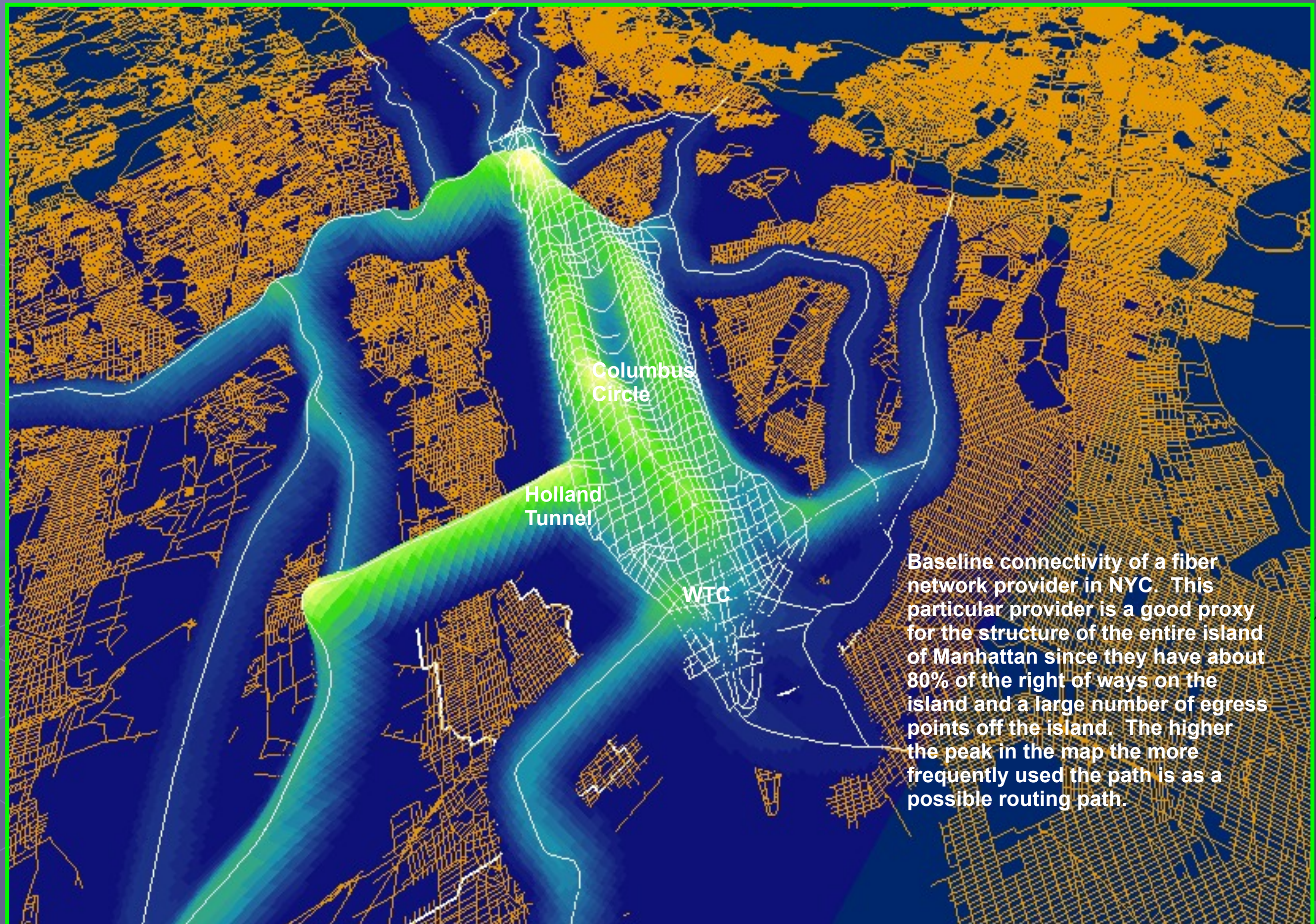
Fiber Density

Electric
Transmission Line
Density











Lastly a scenario is run where just 10,000 sq ft. of damage is done to the Holland Tunnel and the impact calculated. The result is a 8.6% loss of network connectivity, 134 times the impact of the WTC simulation. The dramatic impact is seen in the image from the loss as well as the stress put on the GW Bridge route out of the city.

GeoCommons: Version 1



Welcome, **SeaGor** | [Change Password](#) | [My Profile](#) | [Logout](#)

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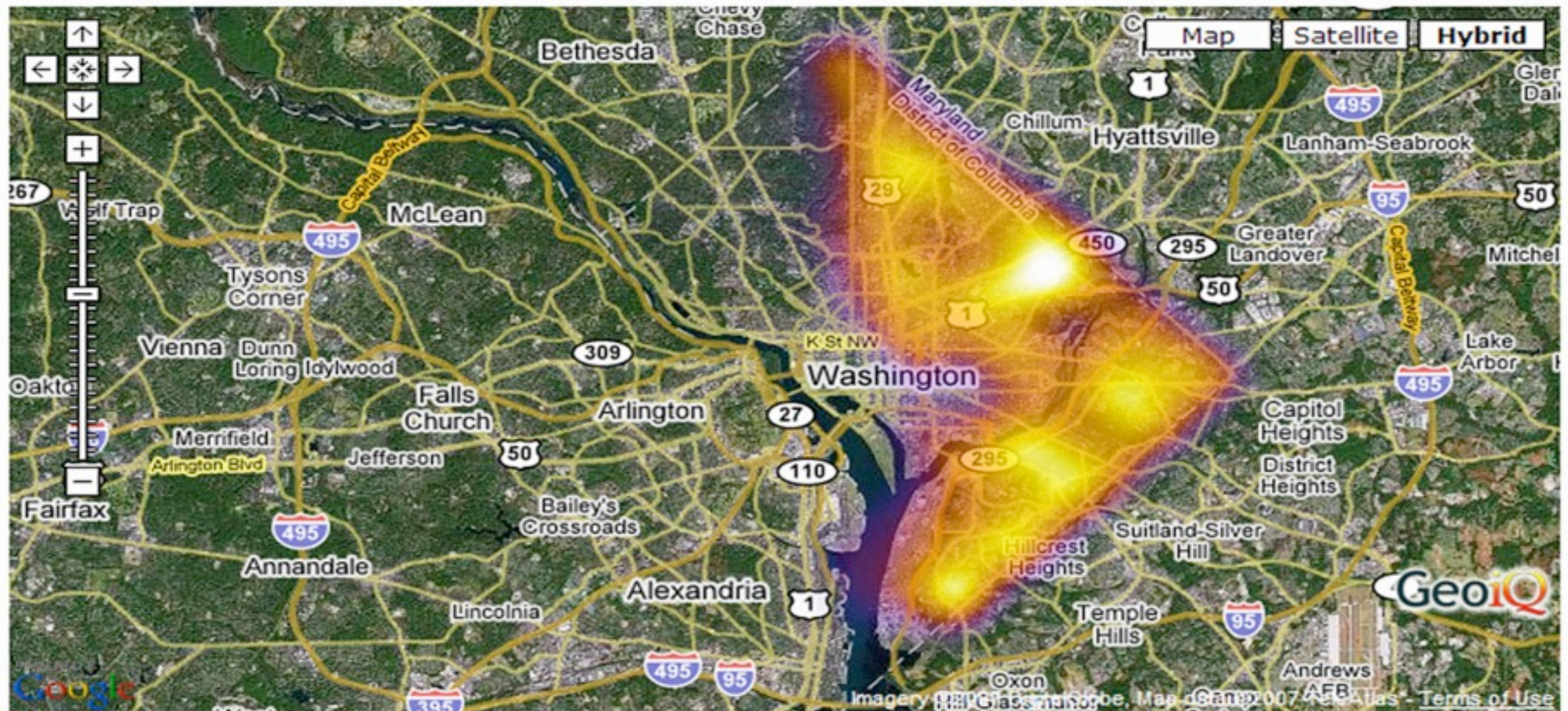
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[Workspace](#)

[Help](#)

My Workspace



Analysis / Visualization Settings

[My Geobin](#)

[Search](#)

heatmap



low



CONUS Census Tract Demographics





Find
interesting data



Find interesting data > Map a relevant area



Find interesting data > Map a relevant area > Visualize to find meaning



Find
interesting data



Map a
relevant area



Visualize to
find meaning



Layer, Modify,
and Analyze



Find
interesting data



Map a
relevant area



Visualize to
find meaning



Collaborate
with others



Layer, Modify,
and Analyze



Find
interesting data



Map a
relevant area



Visualize to
find meaning



Publish and
share results



Collaborate
with others



Layer, Modify,
and Analyze



Maker!

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We've made it easy to make compelling interactive maps.



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Maker! can get more points, lines, and polygons onto a single map than any javascript map on the web.

Finder!

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Manage your own data using tags and then share your work with everyone.



Common Formats

Upload, download, and convert between Shapefile, CSV, and KML. Talk about handy and easy!

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Finder! Open the World's Data.

Search for geographic data...

Browse by category

Agriculture	Government And Politics	Retail
Business And Labor	Health And Medicine	Science And Environment
Demographics	Infrastructure	Sports And Culture
Economics And Financial	Law Enforcement	Technology
Education	Military And Defense	Travel
Geographical Boundaries	Real Estate	

Introducing Finder!



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Store, Organize and Share your GeoData

Upload a file from your computer

no file selected

Supported formats

- CSV (Spreadsheet) [How to prepare](#)
- KML
- GeoRSS
- Shapefile
- Text Documents

Learn more:
[Finder! Manual](#)

Finder! Open the World's Data.

[← home](#)

House Appropriations Committee HR1, Proposed Americans with Disabilities funds under the stimulus package, USA, 2009

The poly shapefile shows total funds and share of funds by year ('09 and '10) under the stimulus package for the Americans with the Disabilities Act (ADA) by state. The map is based on data from House Appropriations Committee and is included in the just passed HR1 (American Recovery and Reinvestment Act 2009) by the U.S. House of Representatives.

Attributes	Range	Median	Mean	Standard Deviation
State	Text column (no statistics available)			
	State			
Year 2010 funds for ADA	10585000.00 - 760020000.00	97680000.00	140469612.24	150041508.96
	Year 2010 funds for ADA			
Year 2009 funds for ADA	8730000.00 - 662464000.00	85232000.00	120457326.53	128722712.81
	Year 2009 funds for ADA			
State Abbr	Text column (no statistics available)			
	State Abbreviation			

Create



MAKE A MAP
Use GeoCommons Maker! to build a map.

Download



KML
Google Earth, Microsoft Virtual Earth and others.



Shapefile
ESRI, uDig and others.



Spreadsheet
CSV format, Excel, OpenOffice and others.

View In... BETA

[Google Maps](#)

[Microsoft Virtual Earth](#)

Metadata

[FGDC](#)

[ISO 19115](#)

Tags (hint: click to search)

[americans with disabilities act hr1 stimulus package](#)

49 Features **7** Attributes

Uploaded by: Rajendra Kulkarni

When: Tuesday, February 03, 2009

Published: Tuesday, February 03, 2009

Source: House of Representatives, HR1 a...

Citation: <http://www.google.com/uri?q=htt...>

Metadata: <http://online.wsj.com/public/re...>

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Maker!

Map the World's Data.

[Learn how to use Maker.](#)

Find a Map

Browse by category

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Need help getting started?

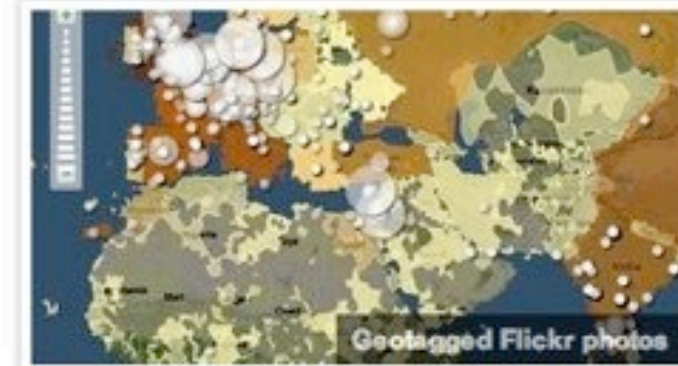
[User Manual](#)

Quick Start

Pick a sample layer to start a map:

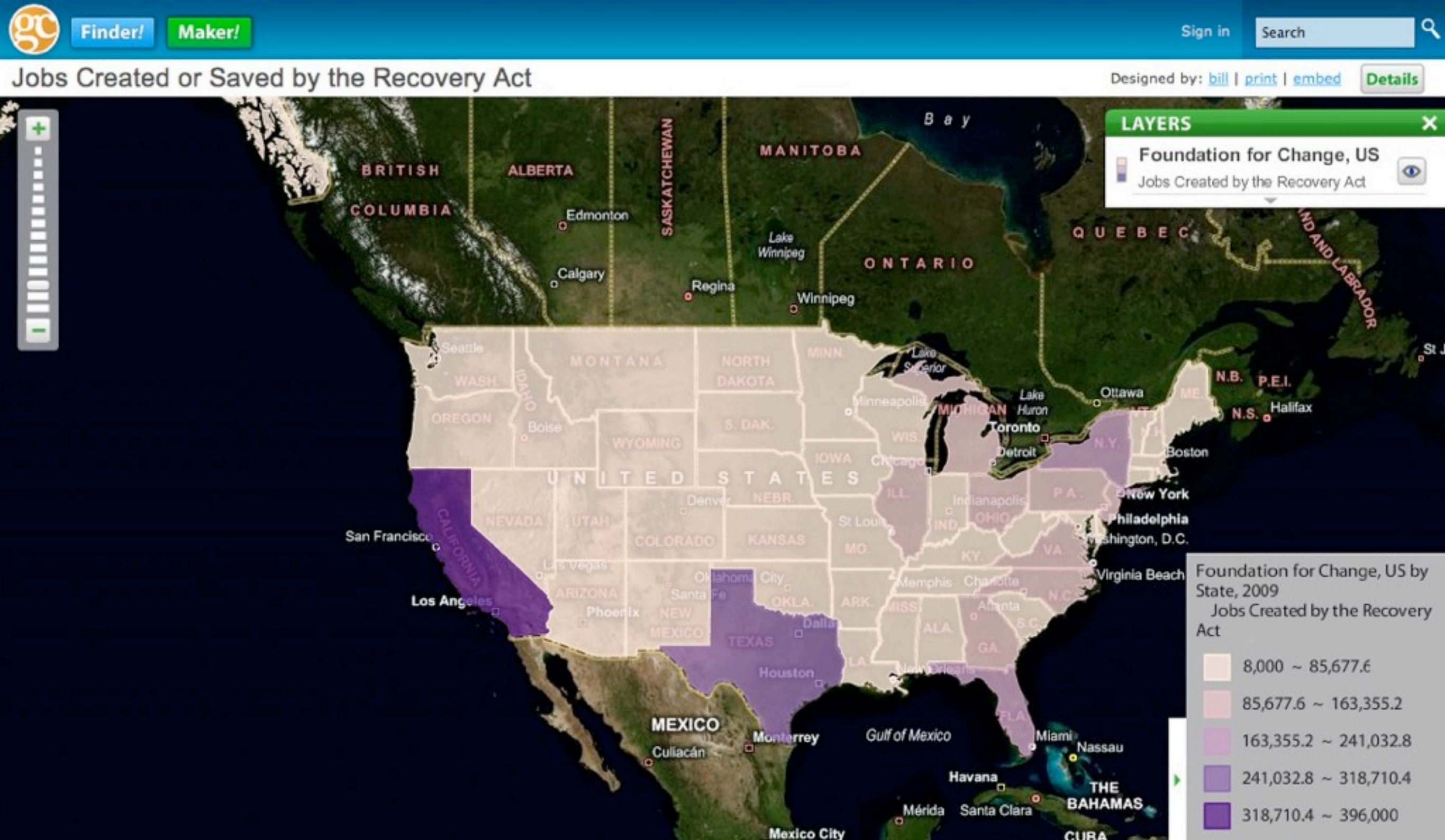
[Earth Trends, Water Resources By Country, Global, 2006-2007](#)[Nation Master, International Water Pollution Issues, Global, 2007](#)[Pollution Concentration in Major Cities, Chile, 2000](#)[UNEP, Pesticides Consumption - Fongicides Bactericides and Pop, World, 1990-2001](#)

Featured Maps

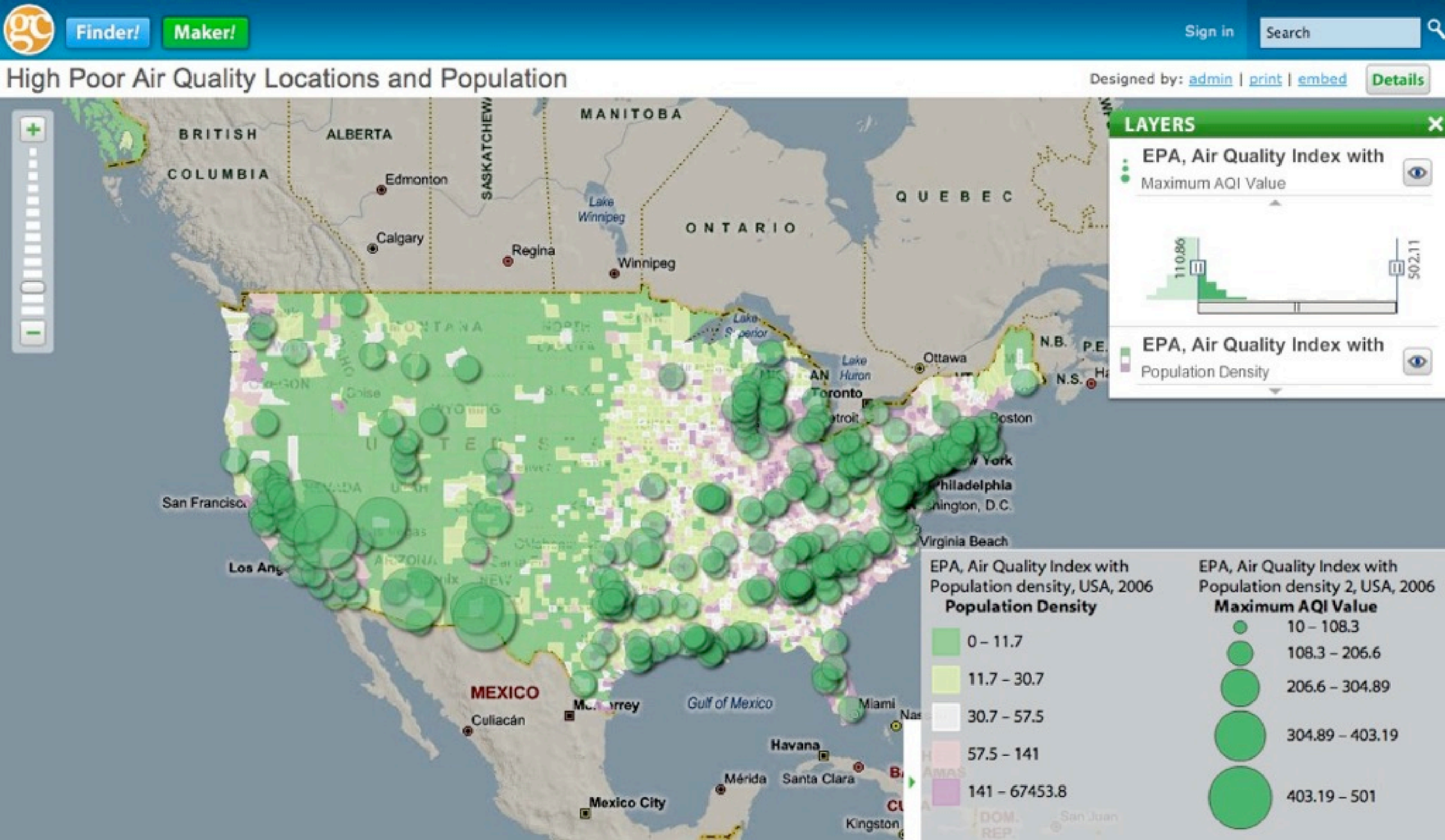


Professional cartography is now in your hands.

Maker! was designed by cartographers with an eye for detail. Style your map with



Visualization

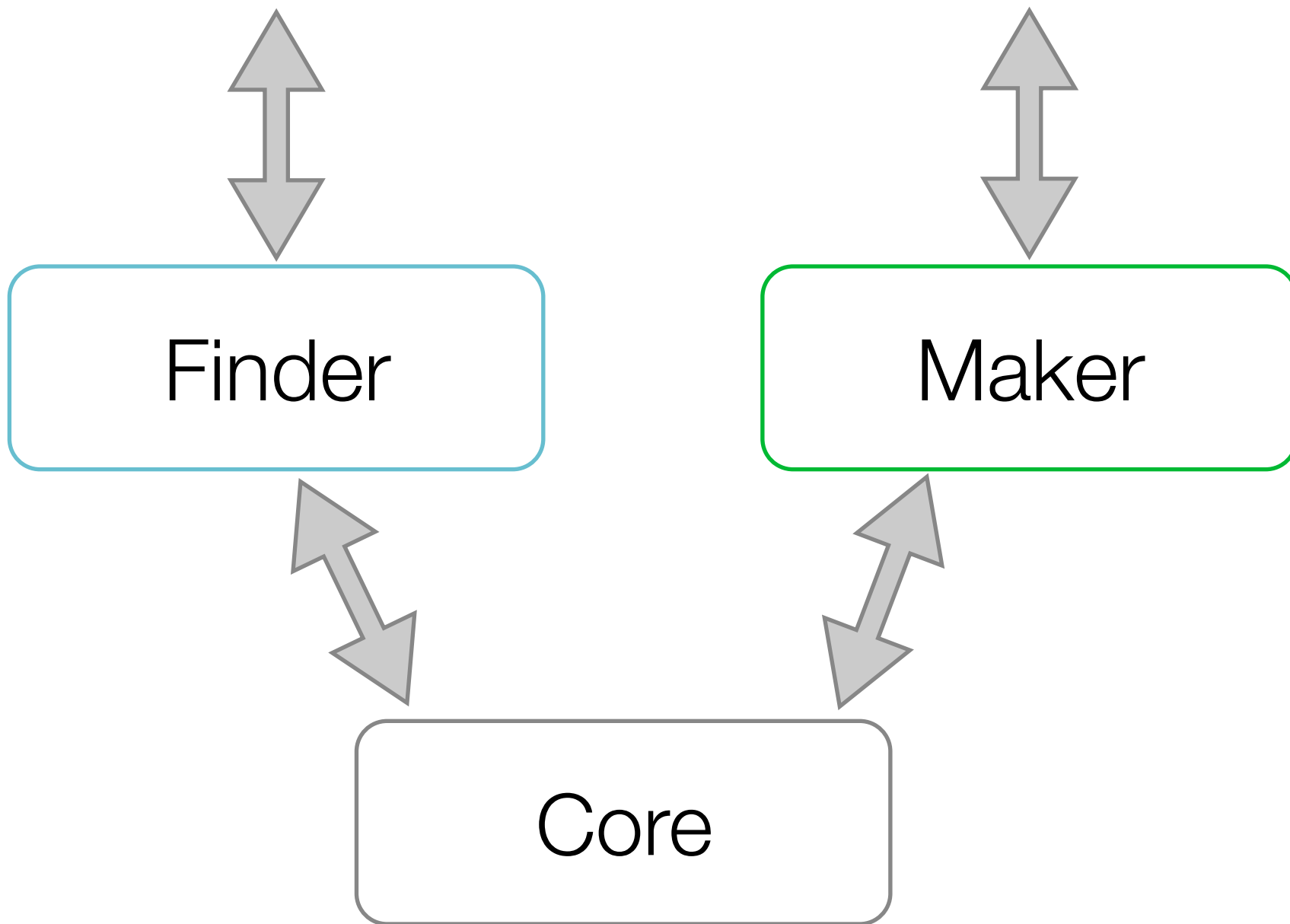


Analysis

Applying Lessons Learned

Modularize

Application Programming Interface



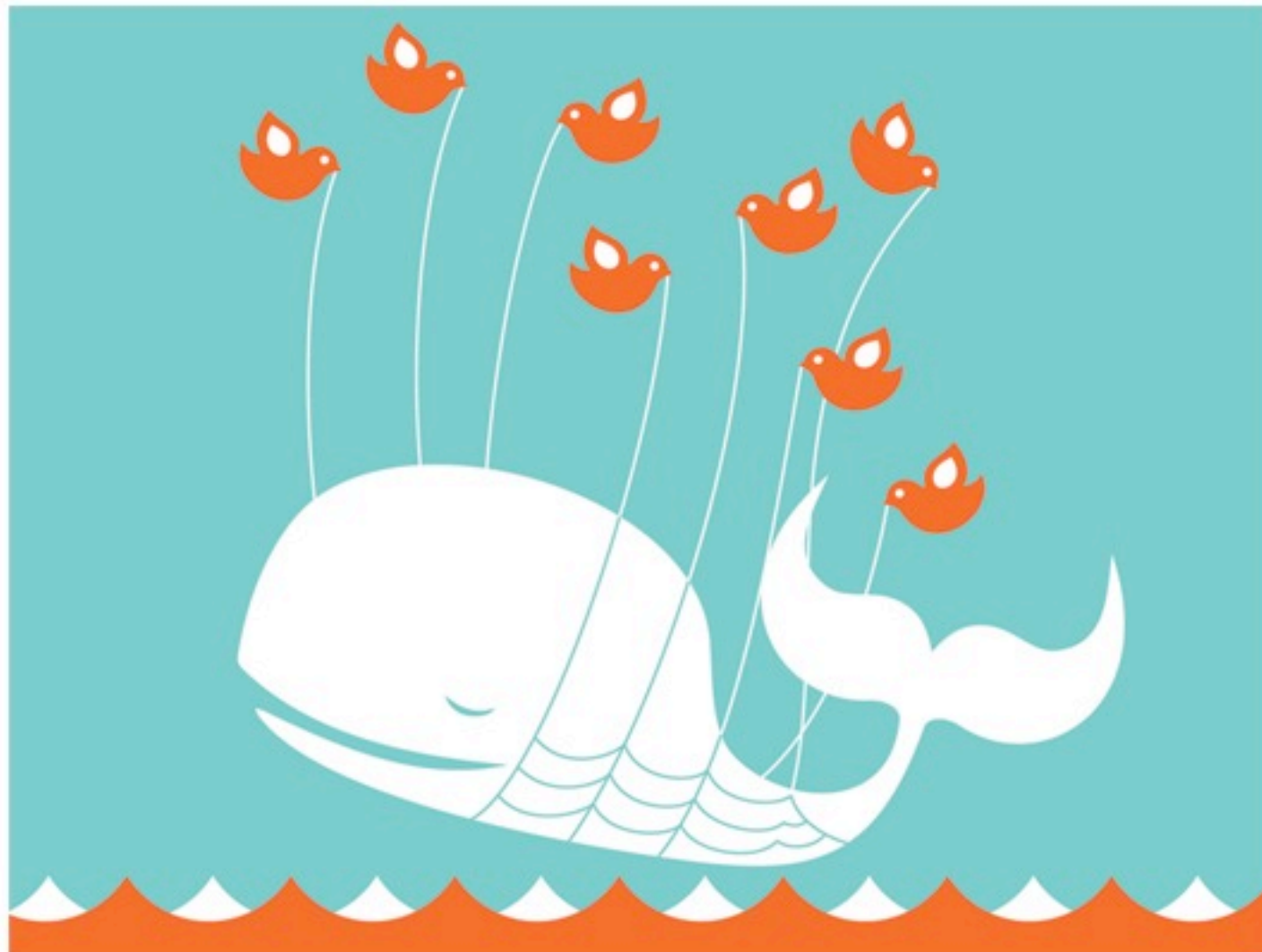
RESTful
Interfaces

Relational Databases Don't Scale Well






twitter

Twitter is currently down for database replication catchup.

We expect to be back in about ten minutes. Thanks for your patience.



Datasets as Databases

-  KML
-  Shapefile
-  CSV (Excel)
-  GeoRSS
-  Documents

Finder






Maker

Core

Datasets as Databases

Upload



-  KML
-  Shapefile
-  CSV (Excel)
-  GeoRSS
-  Documents

Finder






Maker

Core

Datasets as Databases

Upload



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-  Shapefile
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-  GeoRSS
-  Documents

Finder

Maker

Parse &
Store








Core

Datasets as Databases

Upload



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-  Shapefile
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-  GeoRSS
-  Documents

Finder

Maker

Parse &
Store








Core



Datasets as Databases

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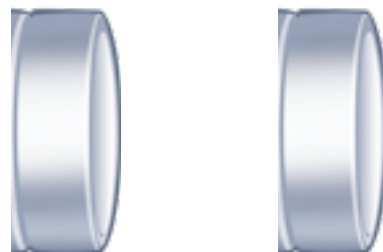
Finder

Maker

Parse &
Store








Core



Datasets as Databases

Upload

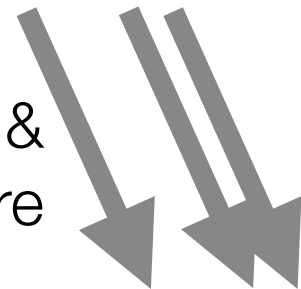


-  KML
-  Shapefile
-  CSV (Excel)
-  GeoRSS
-  Documents

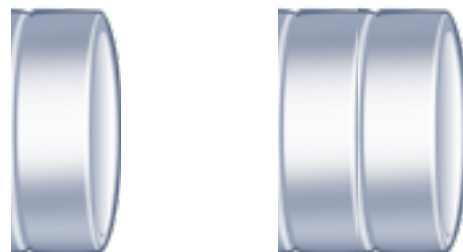
Finder

Maker

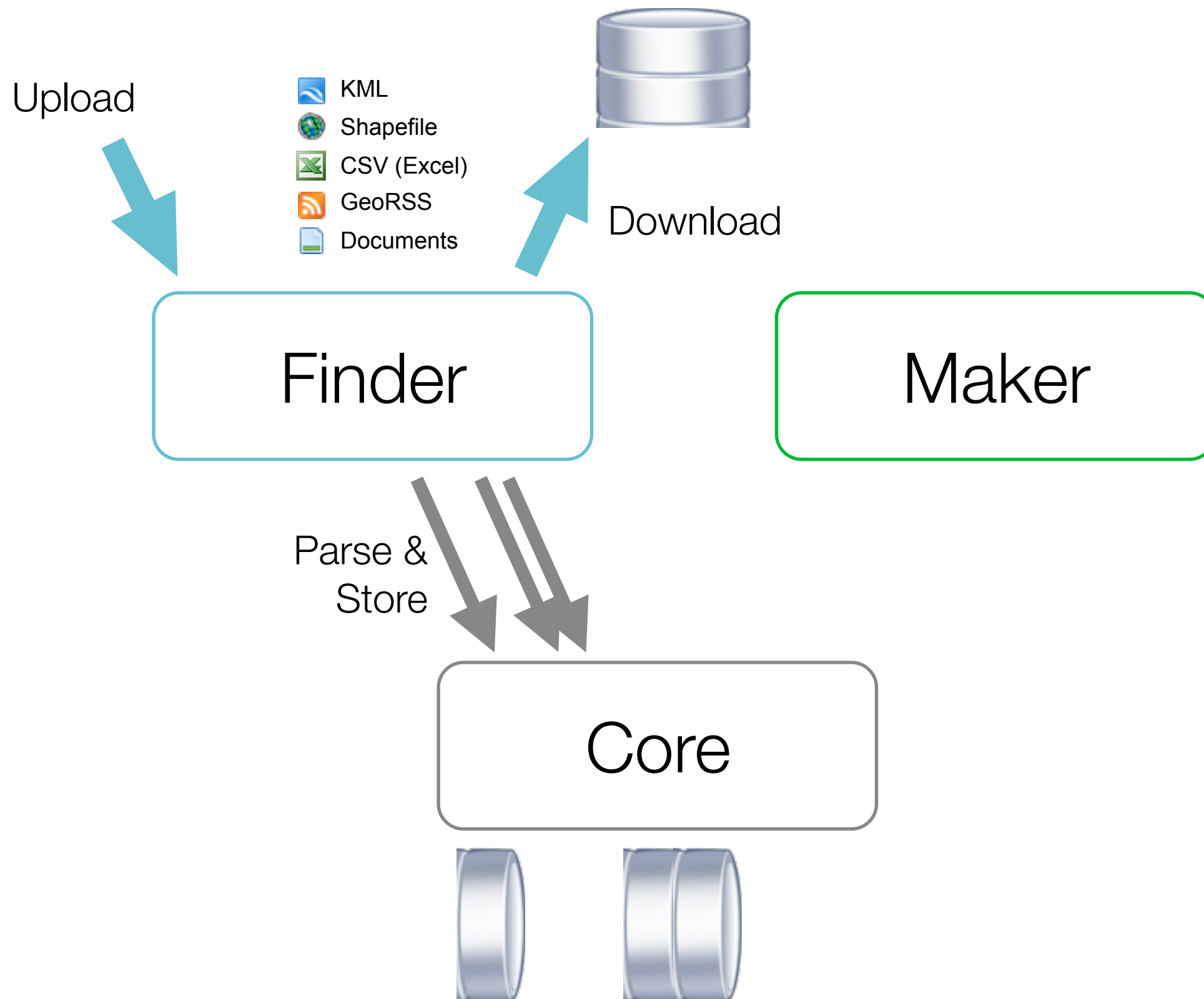
Parse &
Store



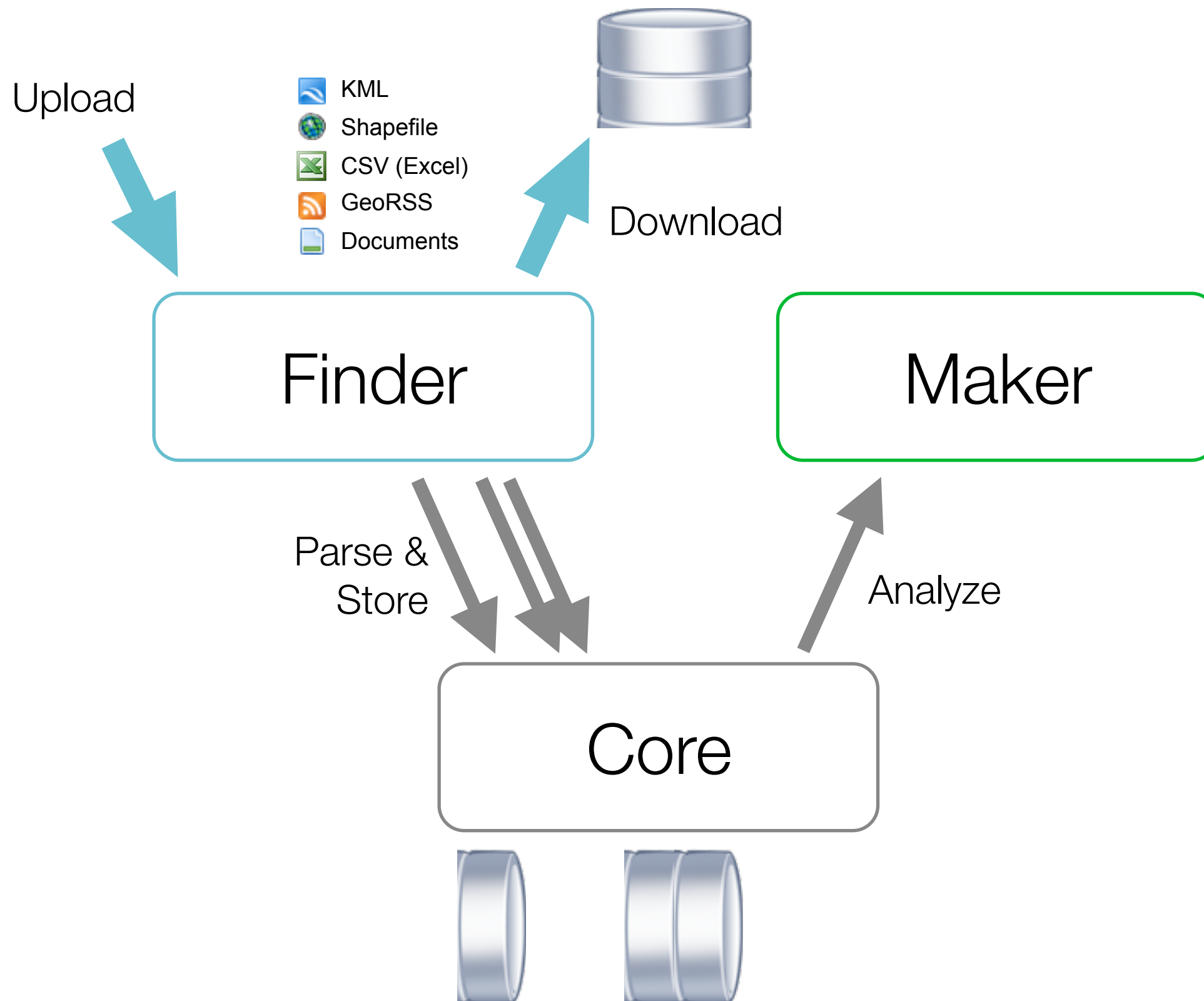
Core



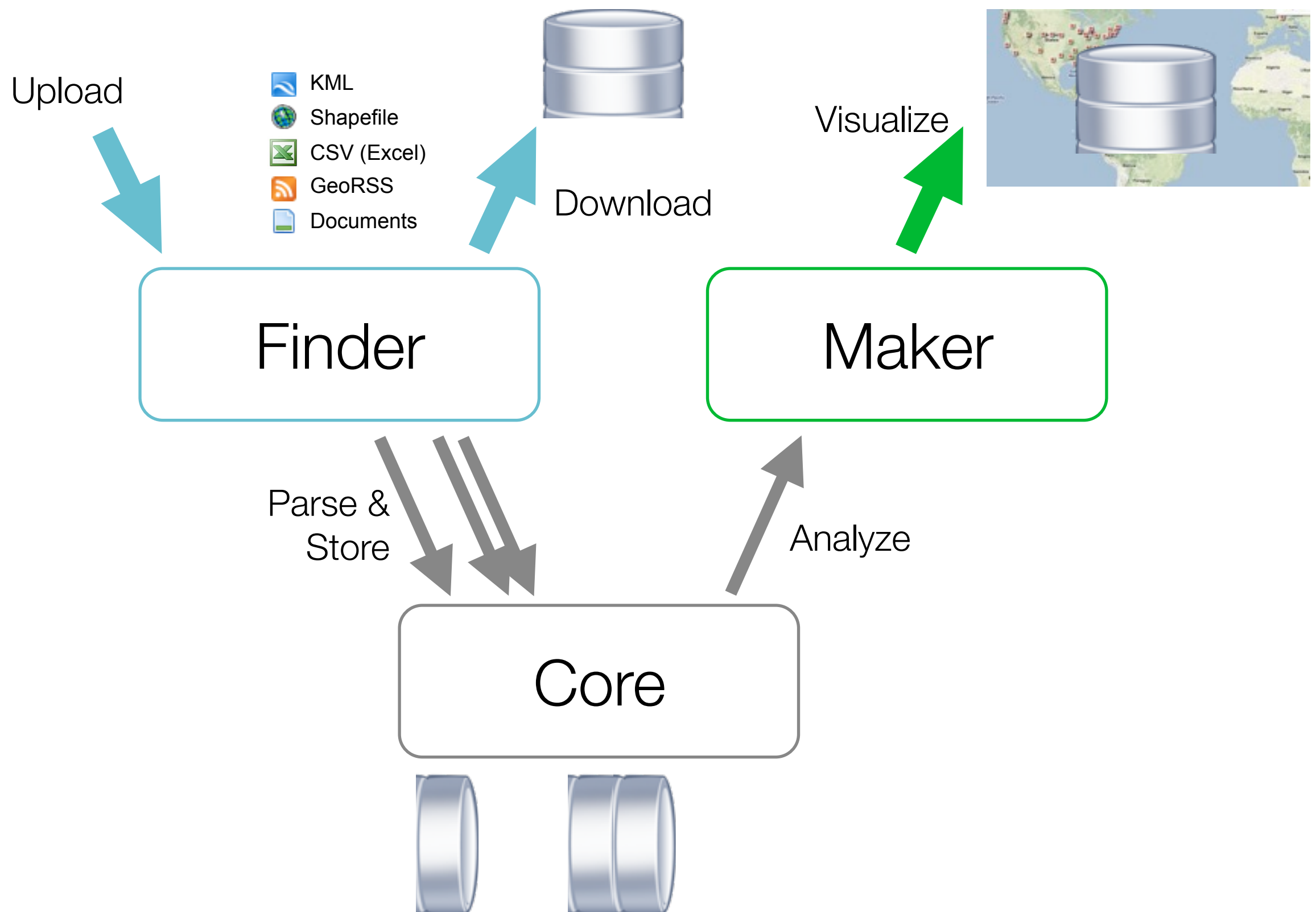
Datasets as Databases



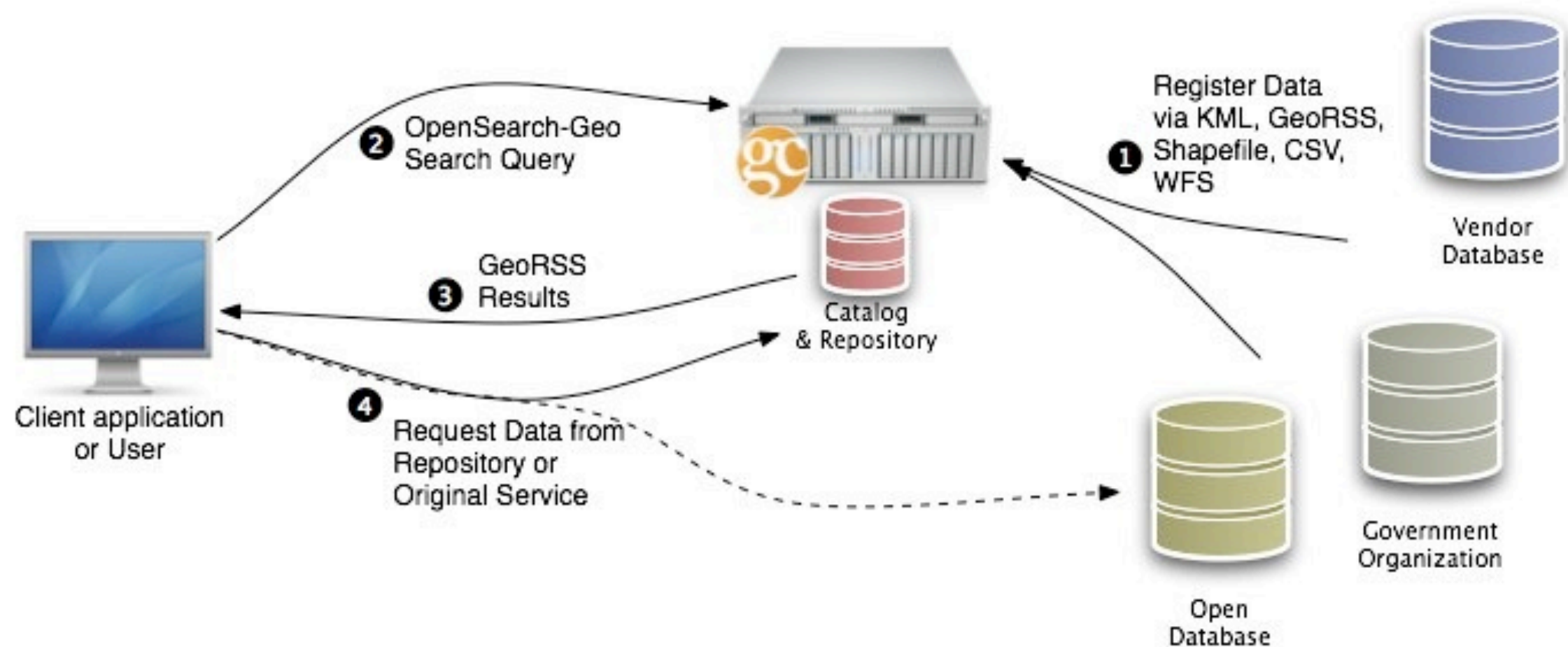
Datasets as Databases



Datasets as Databases



Geospatial Catalog and Server



Delivery Mechanisms



Appliances

- Sun 4150
- RAID Array



Web Scaled Racks

- 3 Appliances
- Network File Storage
- Load Balancer
- Monitoring and Tunnels
- Production & Staging racks
- Racks in office for development



Limits in
Scaling

Limits in
Development

Limits in
Scaling

People

Limits in
Development

Limits in
Scaling

People
Power

Limits in
Development

Limits in Scaling

People
Power
Size

Limits in Development

Limits in Scaling

People
Power
Size
Cost

Limits in Development

Limits in Scaling

People
Power
Size
Cost
Time

Limits in Development

Limits in Scaling

People
Power
Size
Cost
Time

Limits in Development

Limits in Scaling

People
Power
Size
Cost
Time

Limits in Development

Testing on “clean” machines

Limits in Scaling

People
Power
Size
Cost
Time

Limits in Development

Testing on “clean” machines

Deployment testing of
upgrades

Limits in Scaling

People
Power
Size
Cost
Time

Limits in Development

Testing on “clean” machines

Deployment testing of
upgrades

Controlled Environments



Leveraging the Cloud

Amazon Web Services



Management Consoles

The screenshot shows the Amazon EC2 Management Console dashboard. At the top, there's a navigation bar with the Amazon Web Services logo, a 'Contact Us' link, and a 'Create an AWS Account' button. Below this is a secondary navigation bar with links for 'About AWS', 'Products', 'Solutions', 'Resources', 'Support', and 'Your Account'. The main header area includes a breadcrumb trail: 'Home > Your Account > AWS Management Console BETA', and a user greeting: 'Welcome, Test Account | Settings | Sign Out'.

The dashboard is divided into three main sections: 'Overview', 'Amazon EC2' (selected), and 'Amazon Elastic MapReduce'. The 'Amazon EC2' section is further divided into 'Navigation' and 'Amazon EC2 Console Dashboard'.

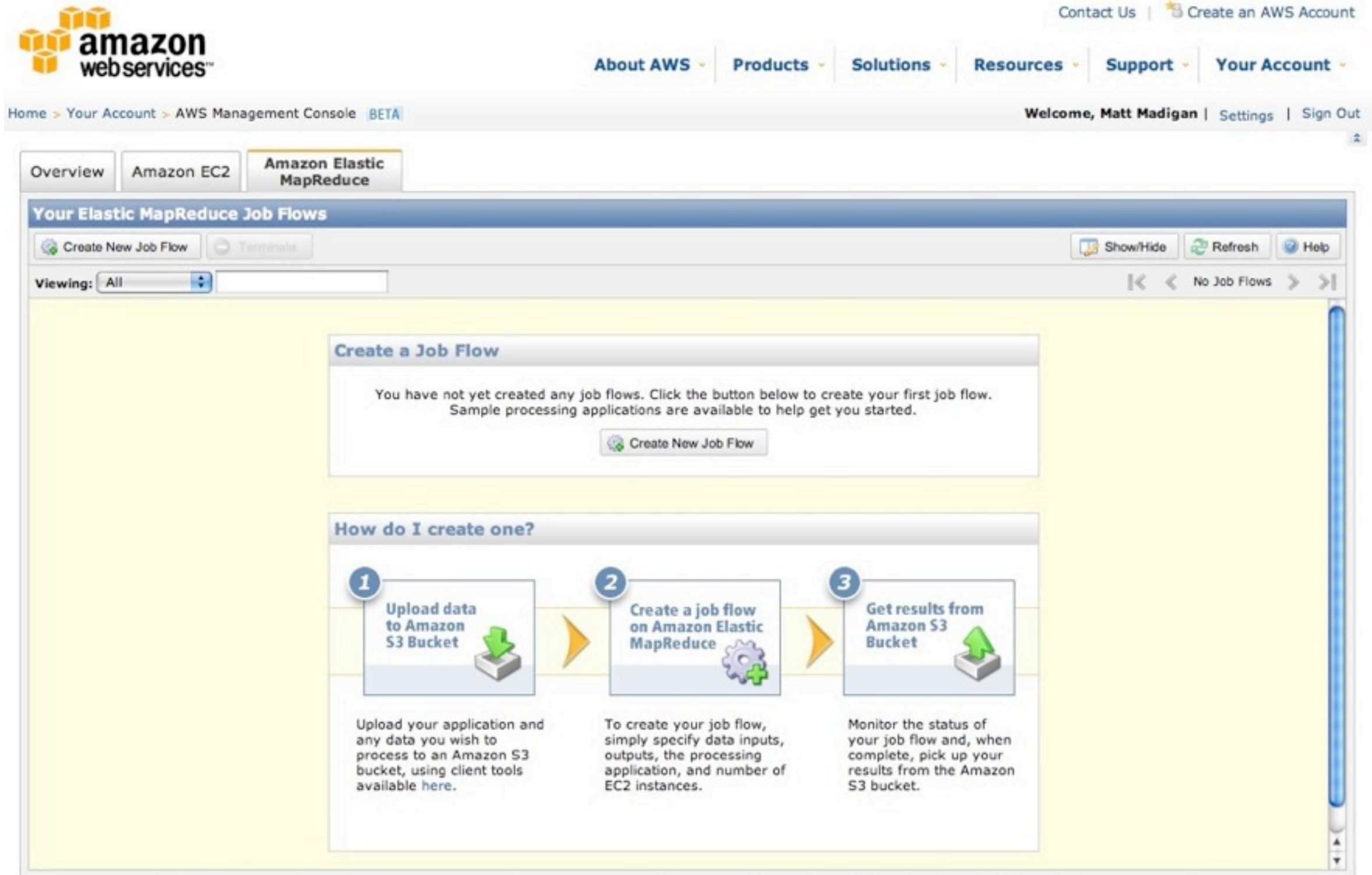
Navigation: This sidebar contains a 'Region' dropdown set to 'US-East'. Below it are several expandable sections: 'EC2 Dashboard', 'INSTANCES' (with a sub-link for 'Instances'), 'IMAGES' (with sub-links for 'AMIs' and 'Bundle Tasks'), 'ELASTIC BLOCK STORE' (with sub-links for 'Volumes' and 'Snapshots'), and 'NETWORKING & SECURITY' (with sub-links for 'Elastic IPs', 'Security Groups', and 'Key Pairs').

Amazon EC2 Console Dashboard: This main area is divided into three columns. The left column, titled 'Getting Started', contains a yellow box with the text: 'To start using Amazon EC2 you will want to launch a virtual server, known as an Amazon EC2 instance.' Below this text is a 'Launch Instances' button. A note states: 'Note: Your instances will launch in the US-East region.' The middle column, titled 'Service Health', contains a table with the following data:

Current Status	Details
✓ Amazon EC2 (US)	Service is operating normally View complete service health details

The right column, titled 'My Resources', shows a summary of resources in the US-East region: 10 Running Instances, 5 Elastic IPs, 6 EBS Volumes, 1 EBS Snapshot, 1 Key Pair, and 7 Security Groups. A 'Refresh' button is located next to the resource count. Below this is a 'Related Links' section with links to 'Documentation', 'All EC2 Resources', 'Forums', 'Feedback', and 'Report an Issue'.

Processing via MapReduce



amazon web services™

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[About AWS](#) | [Products](#) | [Solutions](#) | [Resources](#) | [Support](#) | [Your Account](#)

Home > Your Account > AWS Management Console **BETA** Welcome, Matt Madigan | [Settings](#) | [Sign Out](#)

Overview | Amazon EC2 | **Amazon Elastic MapReduce**

Your Elastic MapReduce Job Flows

[Create New Job Flow](#) [Terminate](#) [Show/Hide](#) [Refresh](#) [Help](#)

Viewing: All

« < No Job Flows > »

Create a Job Flow

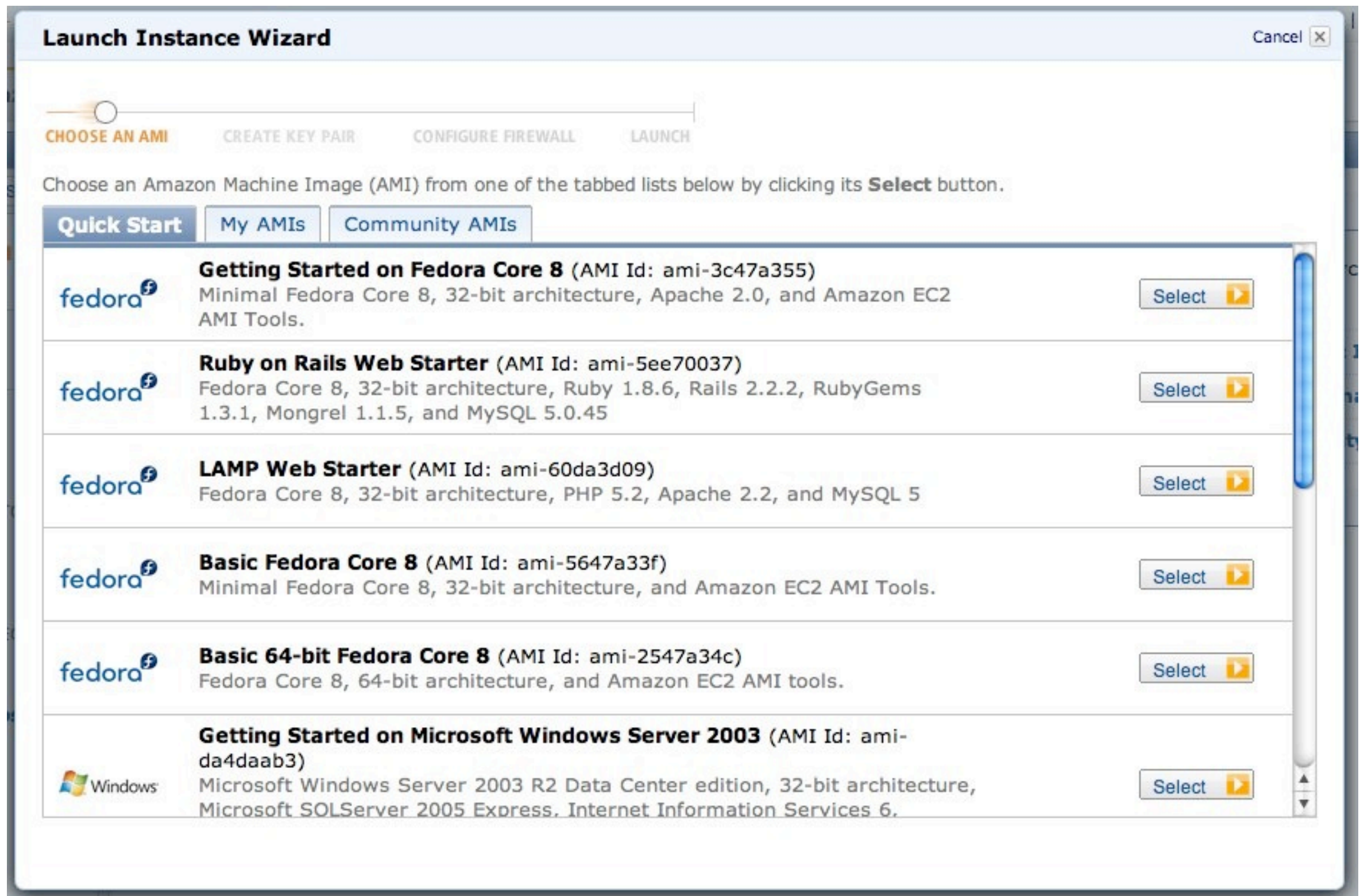
You have not yet created any job flows. Click the button below to create your first job flow. Sample processing applications are available to help get you started.

[Create New Job Flow](#)

How do I create one?

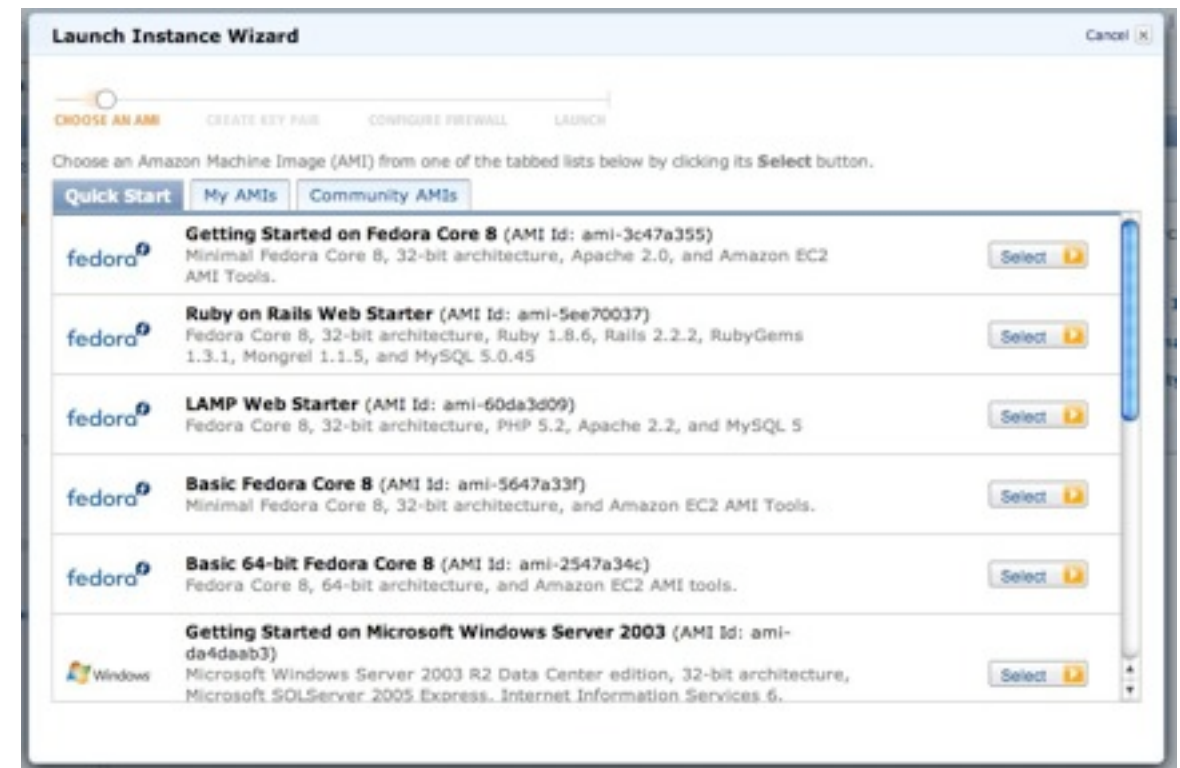
- 1** **Upload data to Amazon S3 Bucket**
Upload your application and any data you wish to process to an Amazon S3 bucket, using client tools available [here](#).
- 2** **Create a job flow on Amazon Elastic MapReduce**
To create your job flow, simply specify data inputs, outputs, the processing application, and number of EC2 instances.
- 3** **Get results from Amazon S3 Bucket**
Monitor the status of your job flow and, when complete, pick up your results from the Amazon S3 bucket.

Launching New Instances



Elastic Computing Cluster - EC2

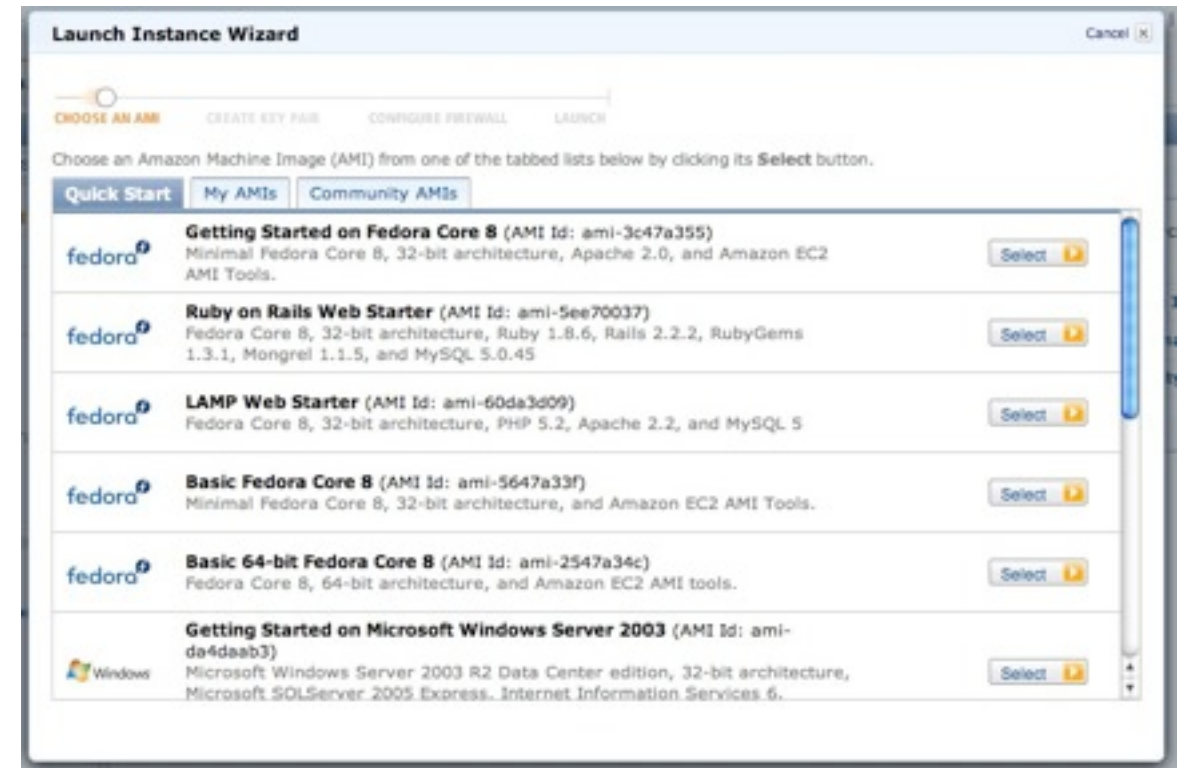
- Virtual Servers
- Machine Images (AMI)
- On-Demand



CentOS AMI

Elastic Computing Cluster - EC2

- Virtual Servers
- Machine Images (AMI)
- On-Demand



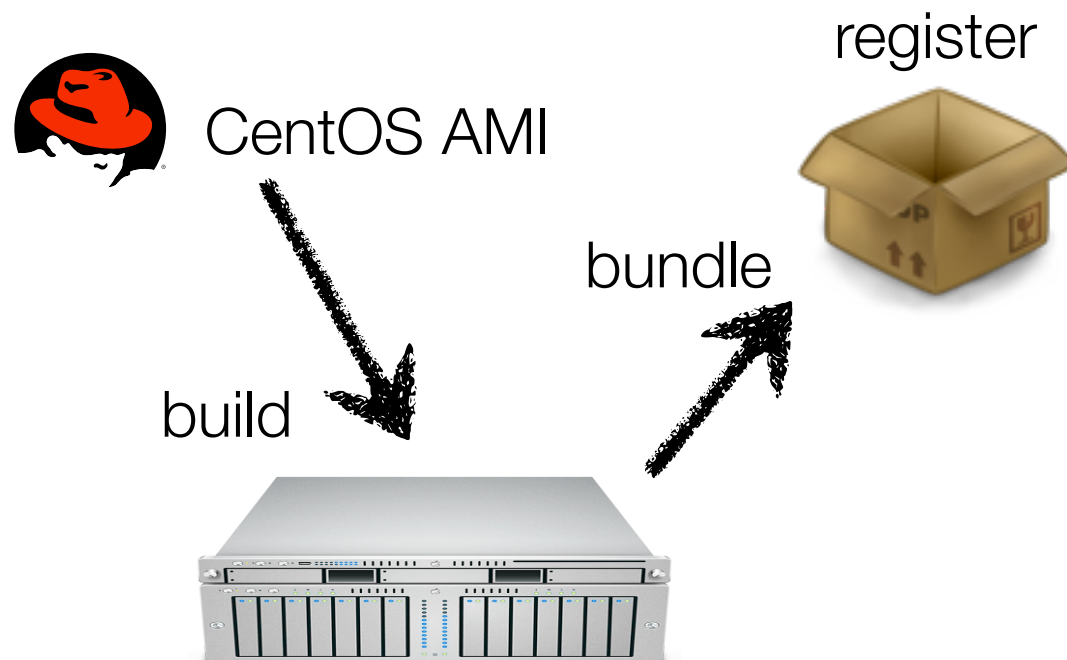
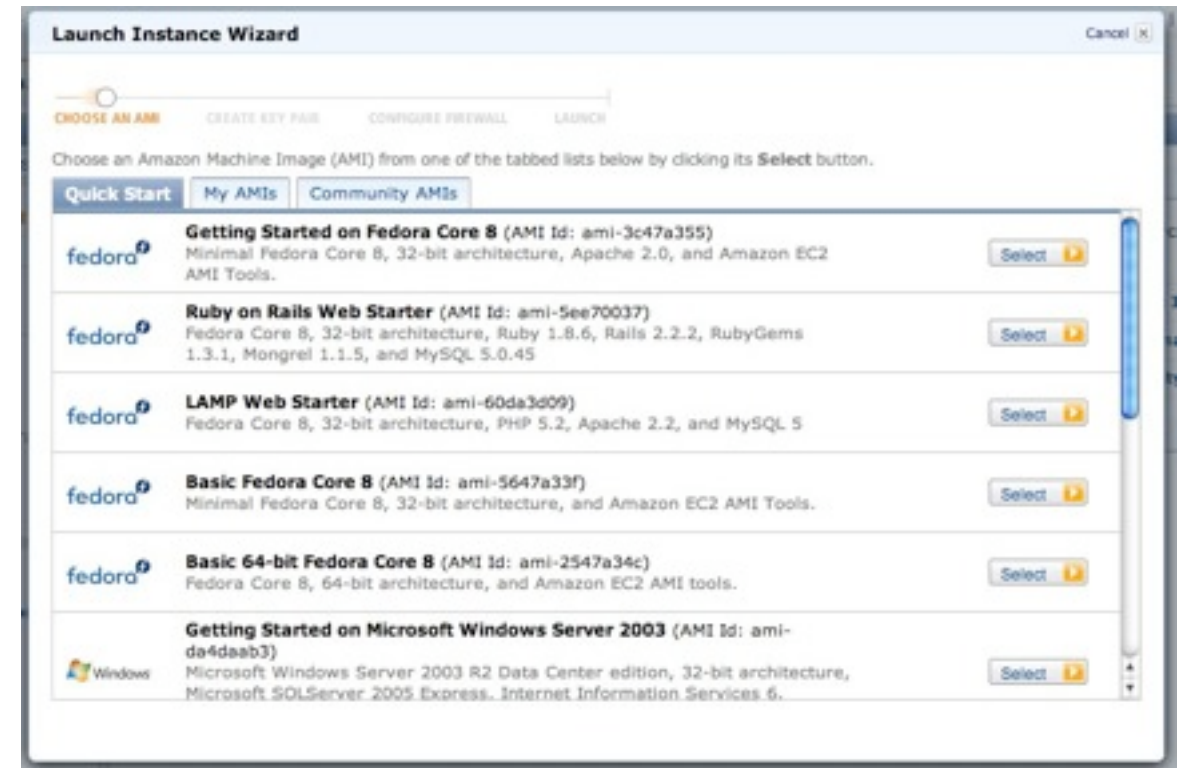
CentOS AMI

build



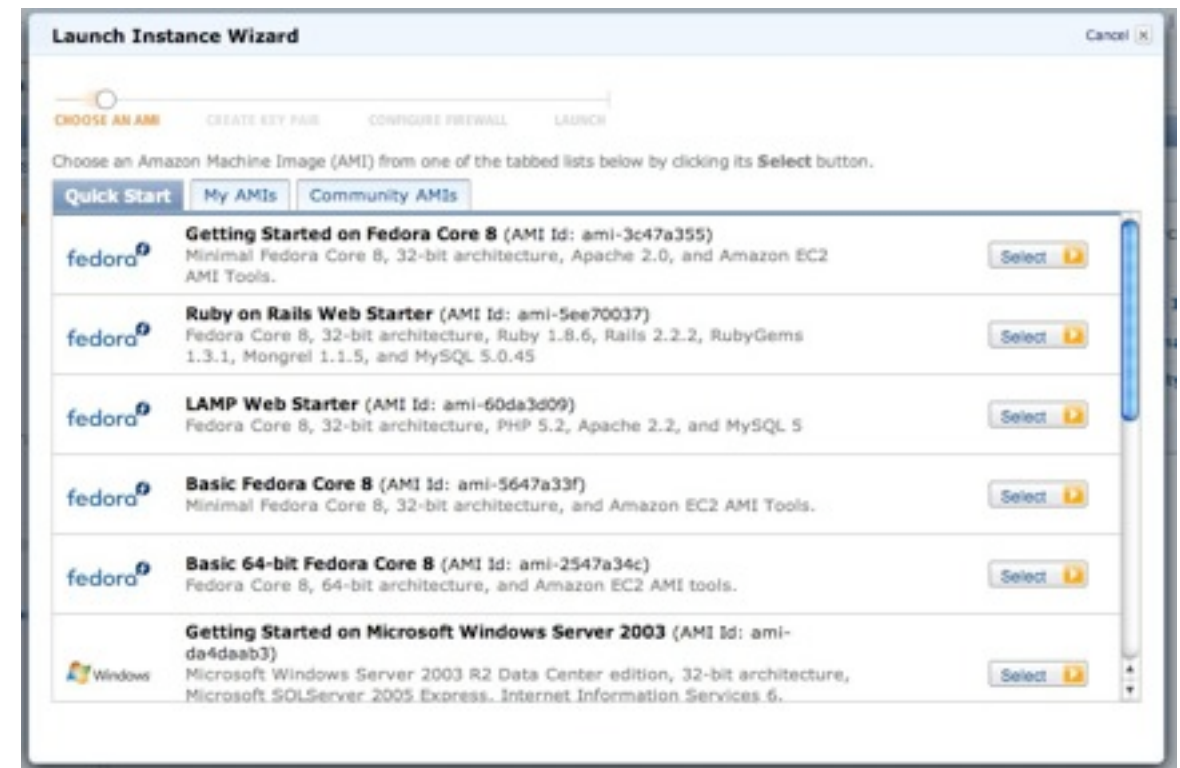
Elastic Computing Cluster - EC2

- Virtual Servers
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Elastic Computing Cluster - EC2

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- On-Demand



CentOS AMI

register



bundle

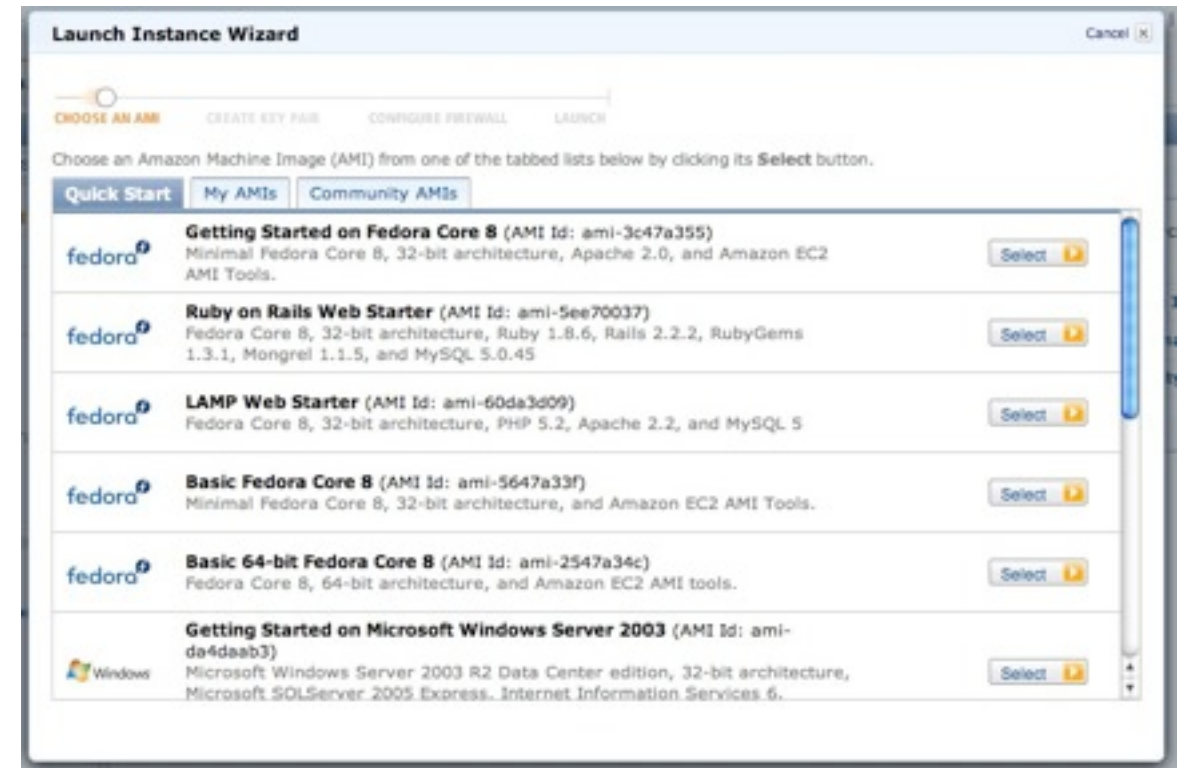
build



instantiate

Elastic Computing Cluster - EC2

- Virtual Servers
- Machine Images (AMI)
- On-Demand



CentOS AMI

build



bundle

register

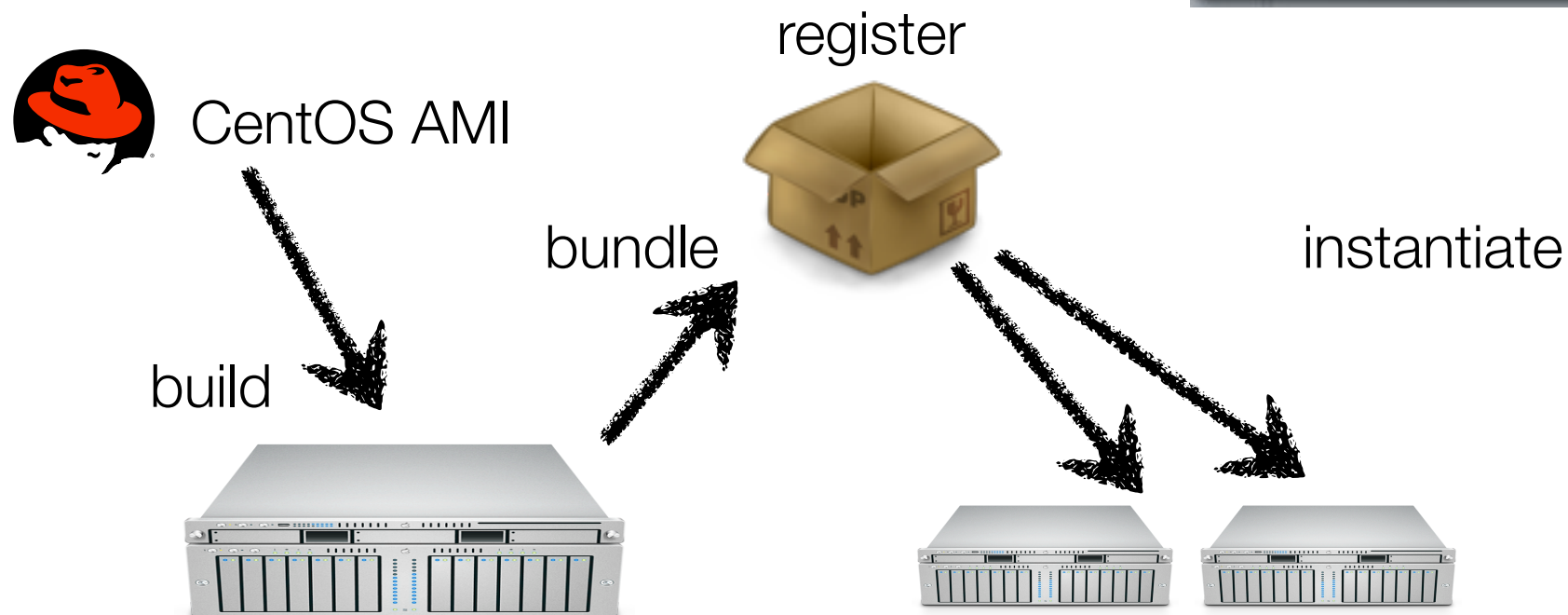
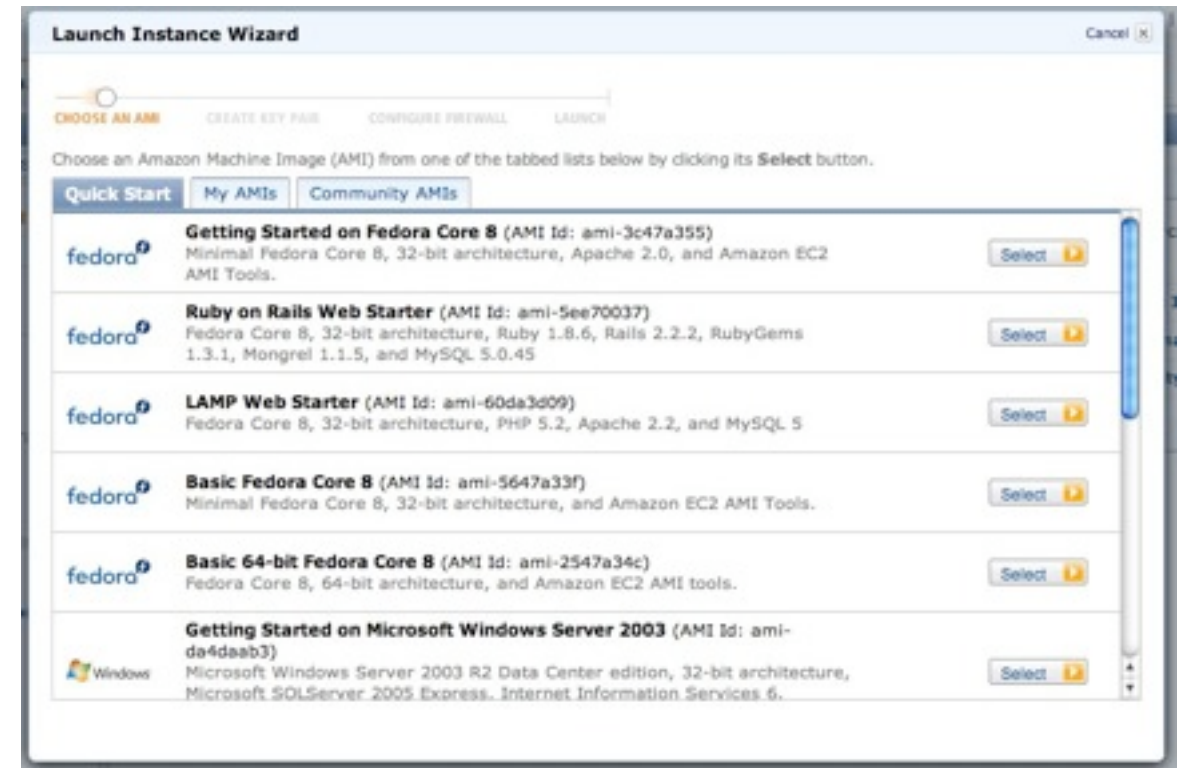


instantiate



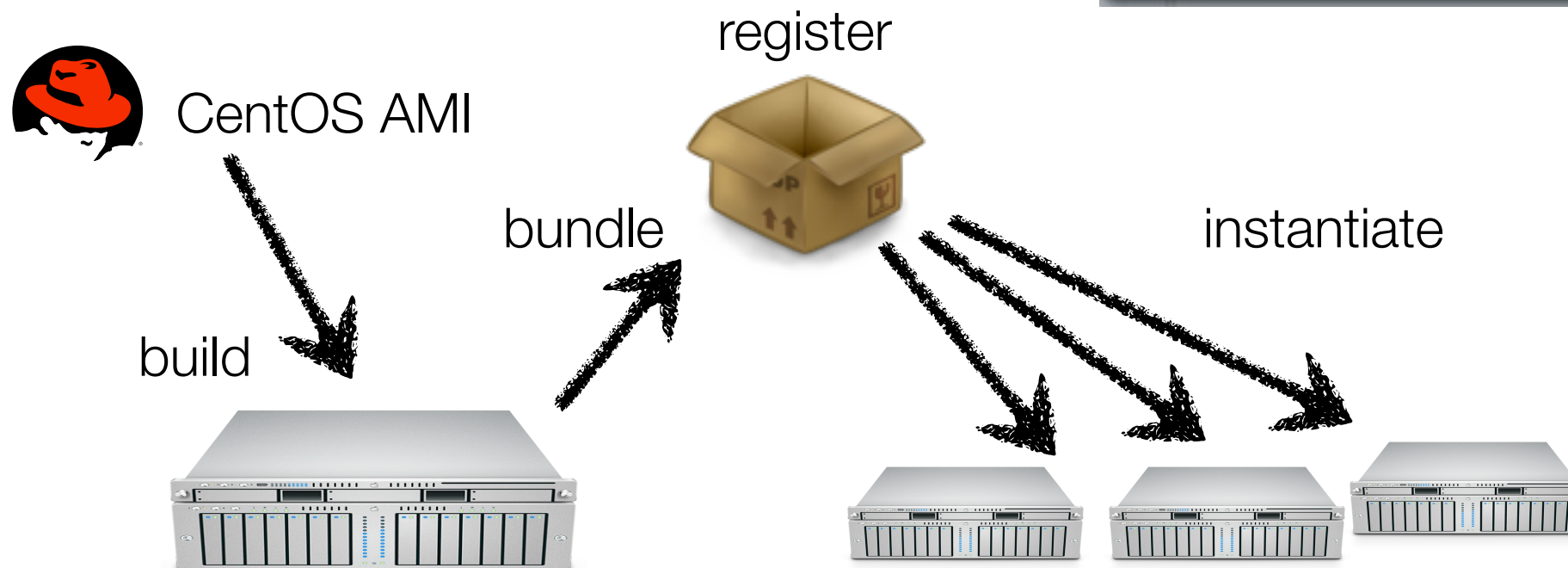
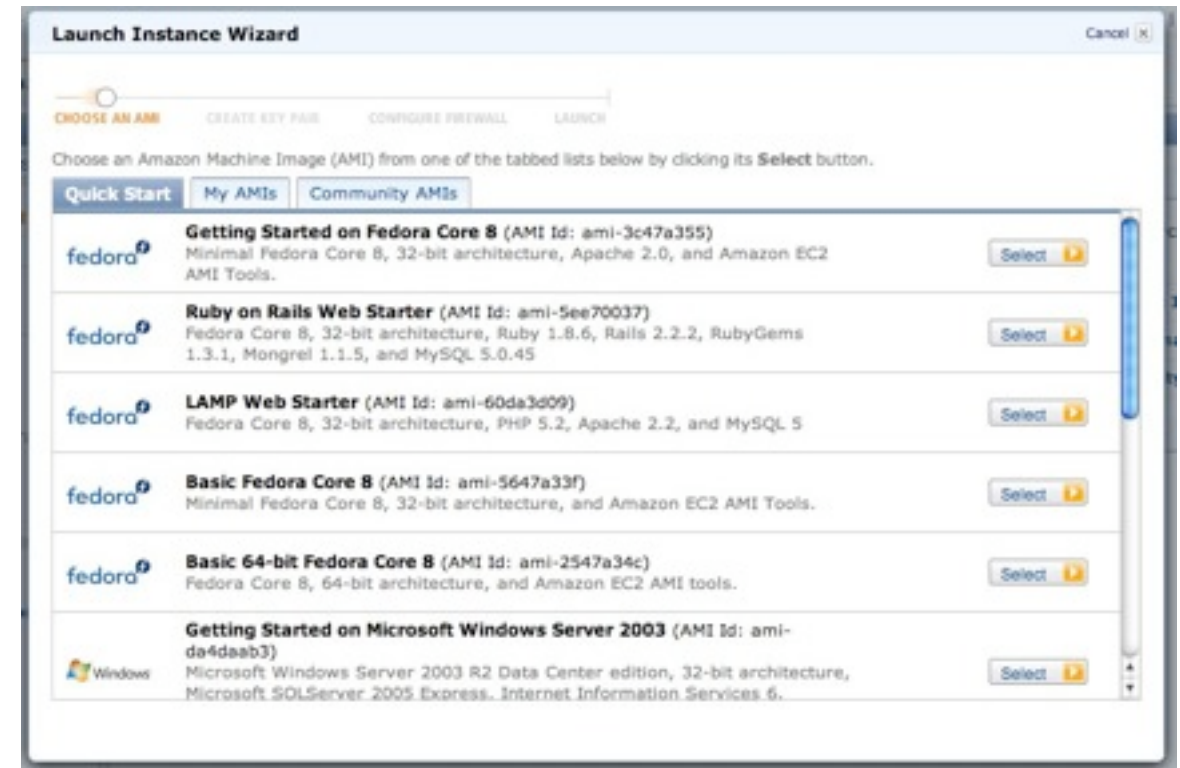
Elastic Computing Cluster - EC2

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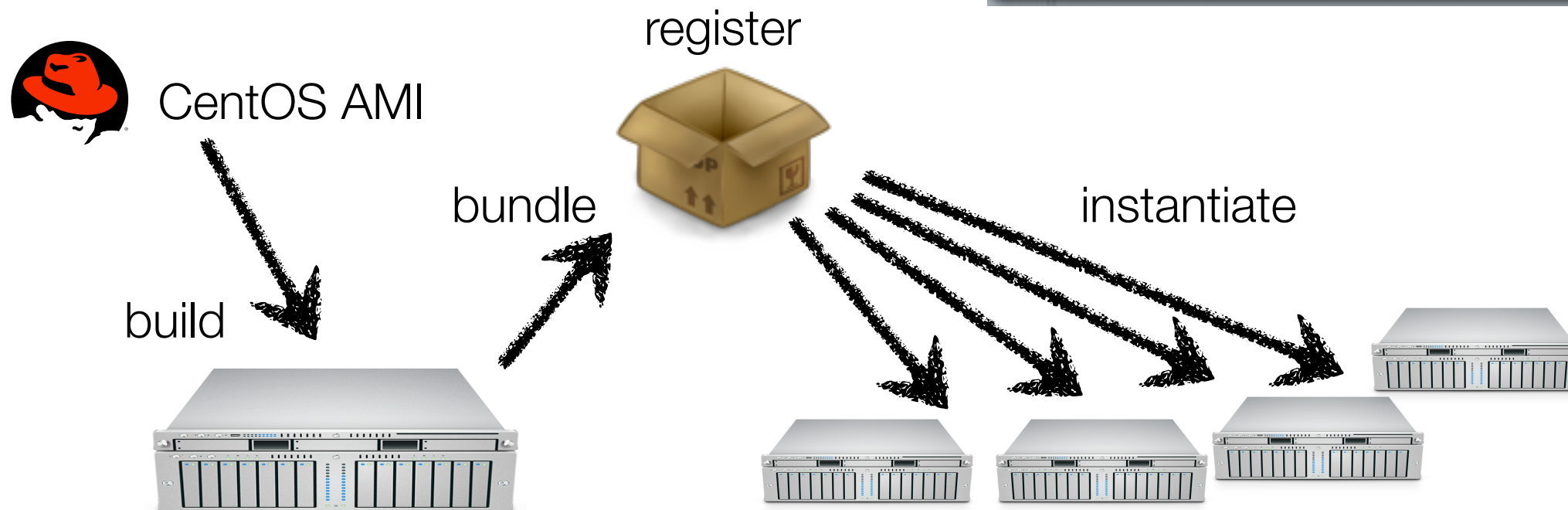
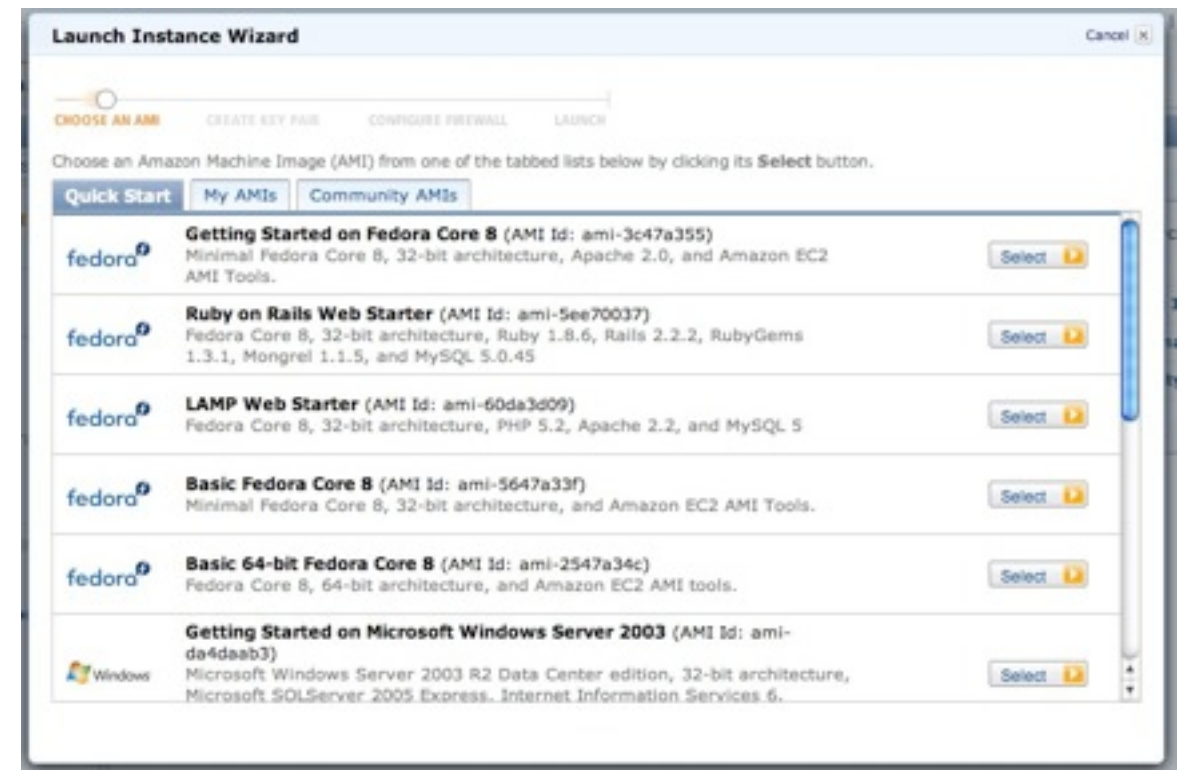
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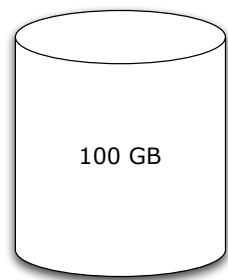
Elastic Computing Cluster - EC2

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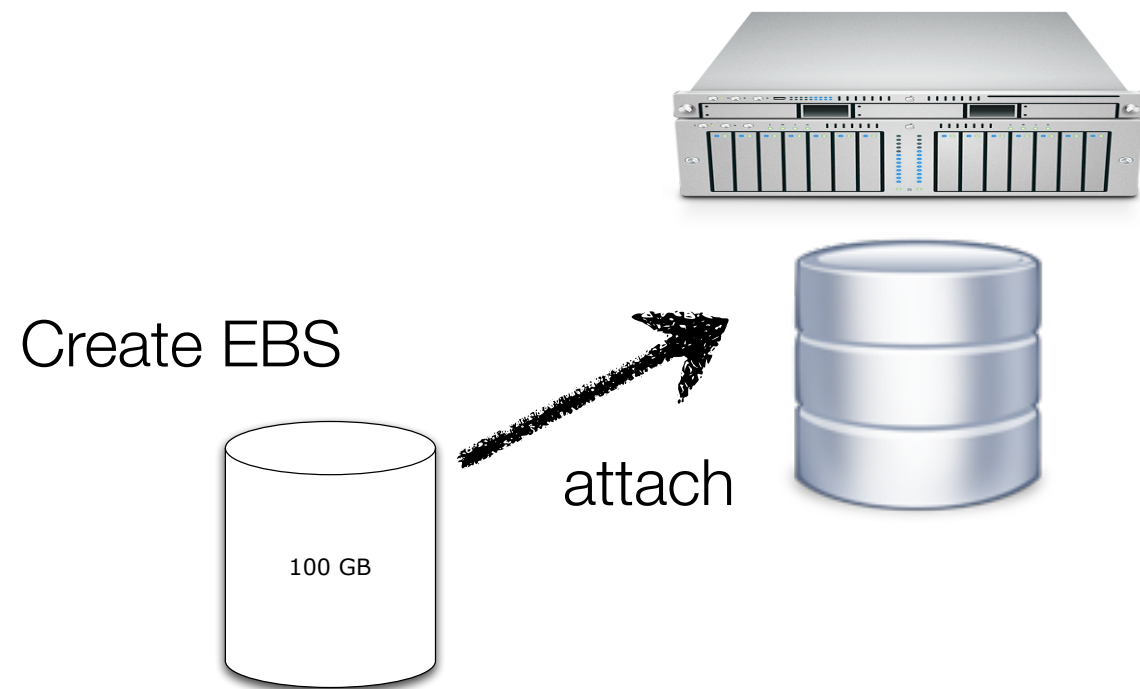


Elastic Block Store - EBS

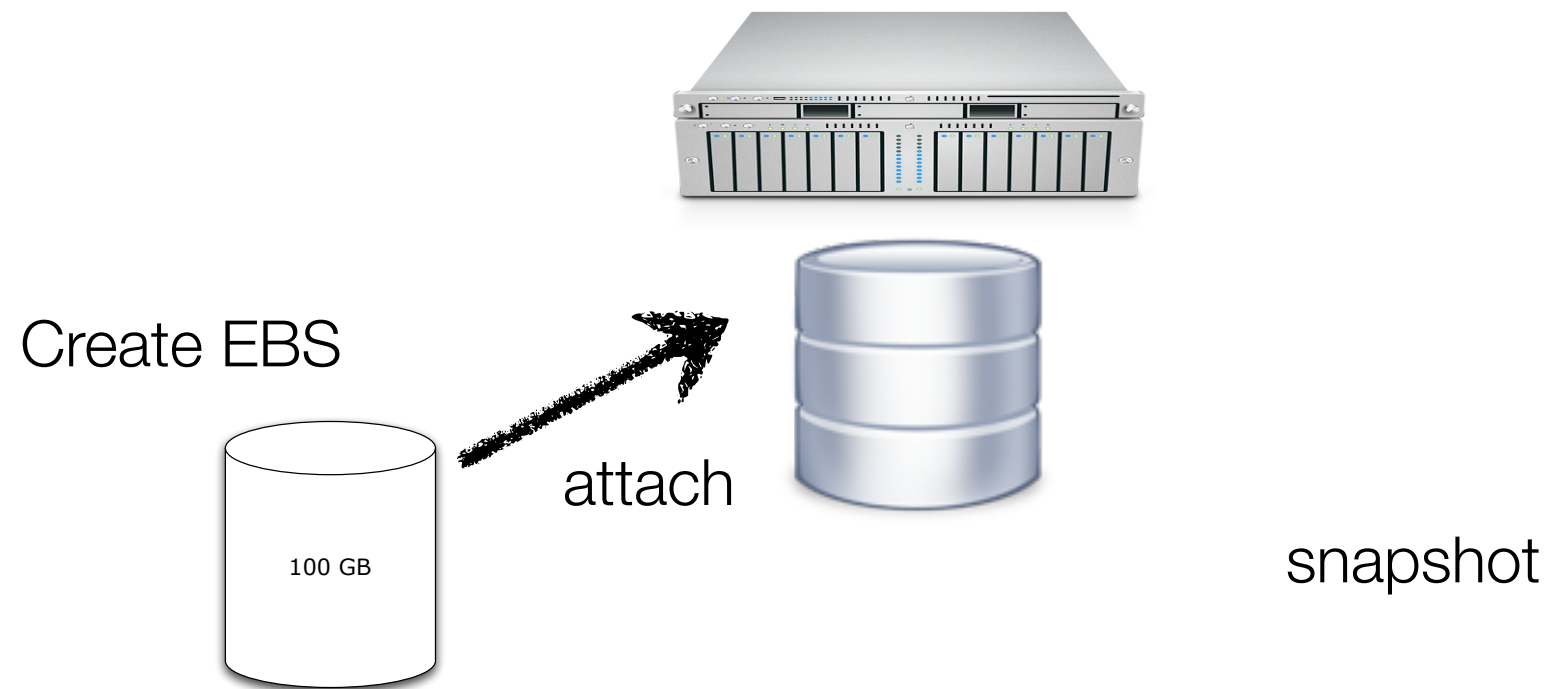
Create EBS



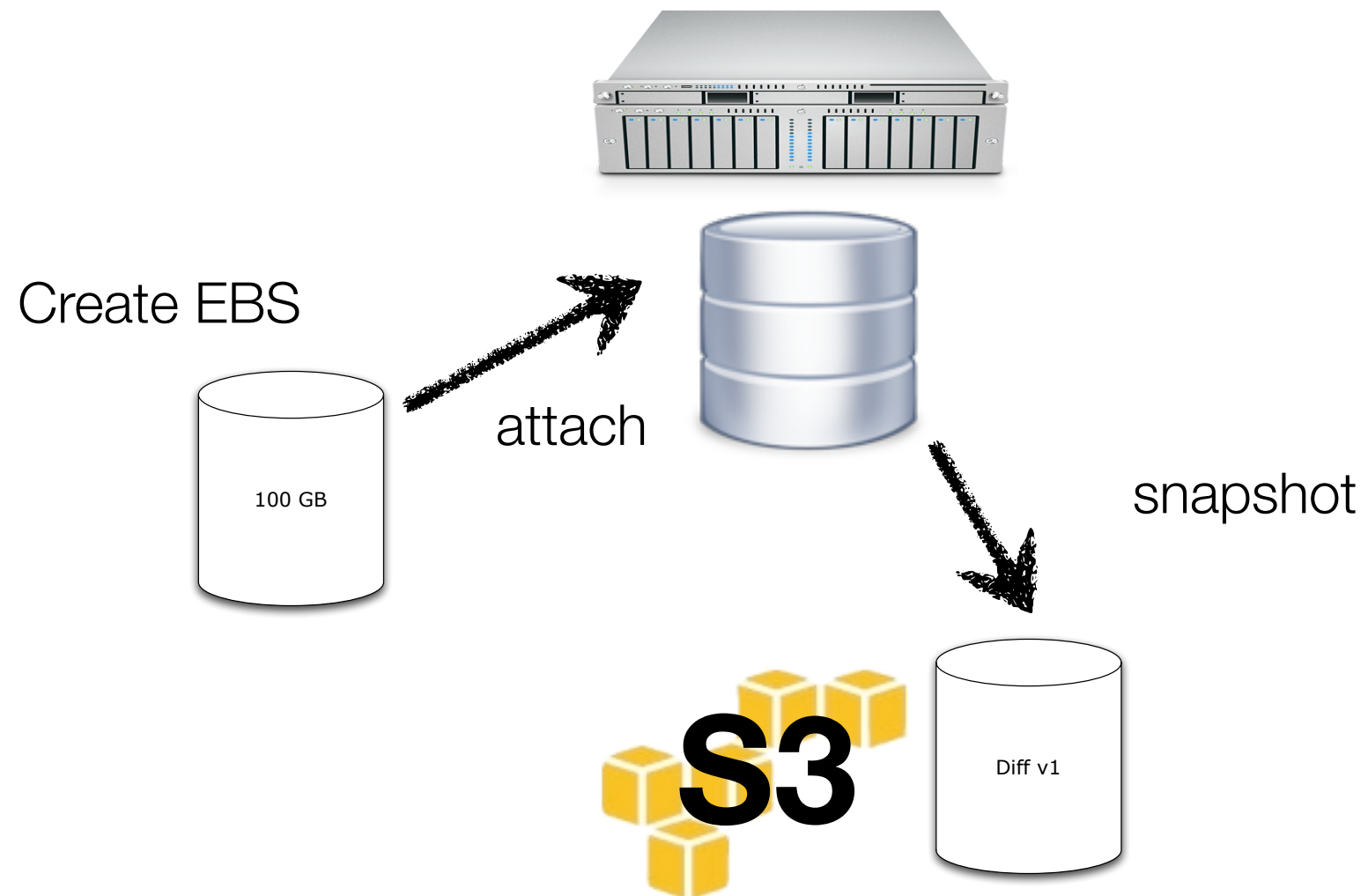
Elastic Block Store - EBS



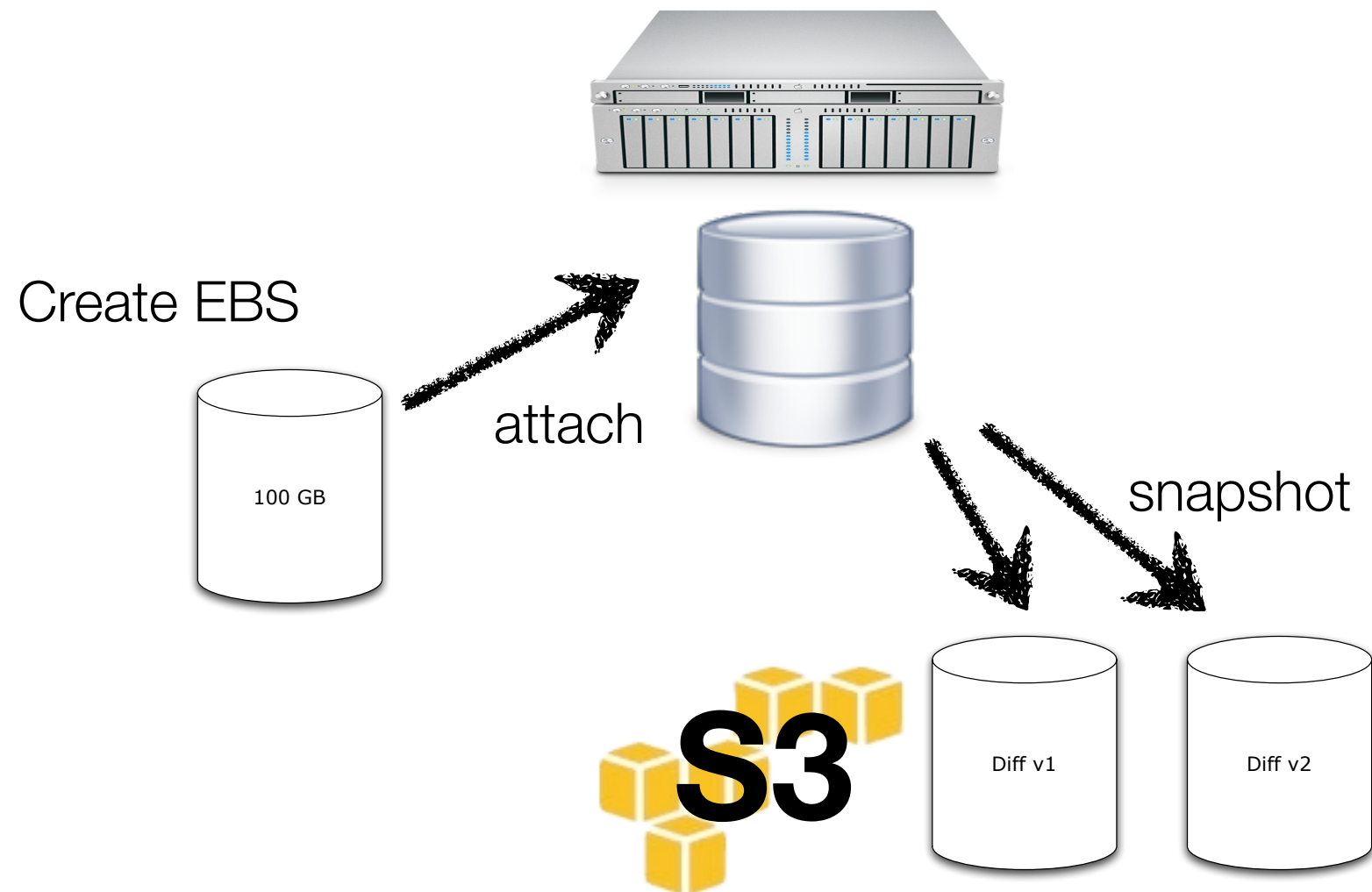
Elastic Block Store - EBS



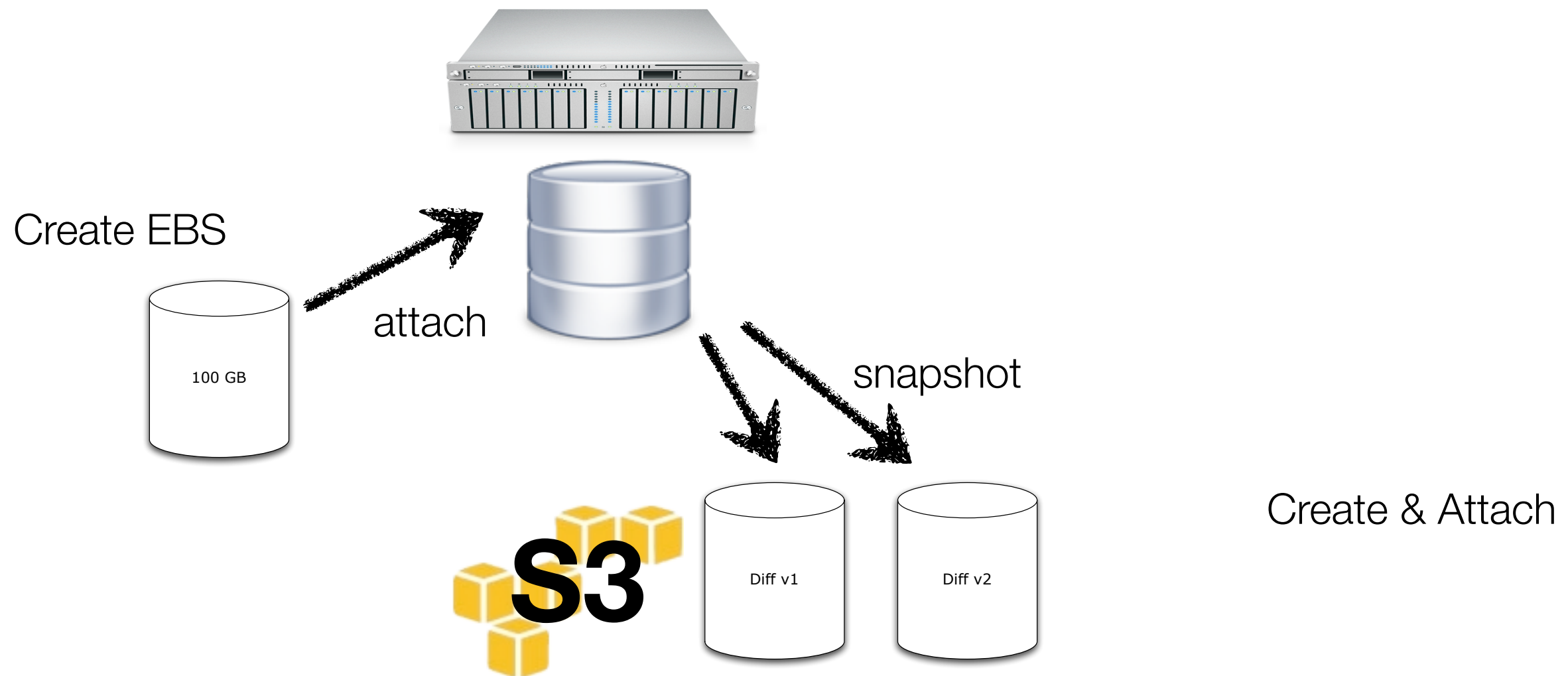
Elastic Block Store - EBS



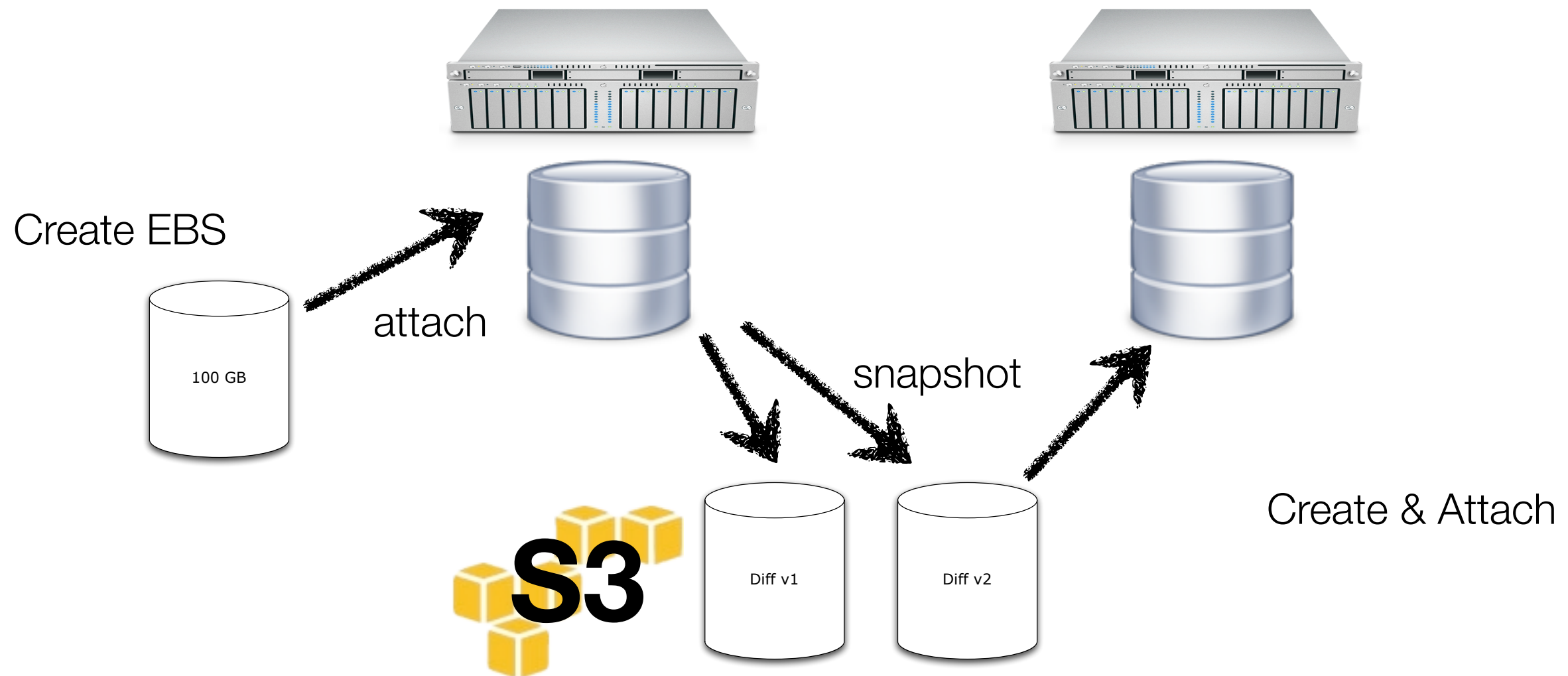
Elastic Block Store - EBS



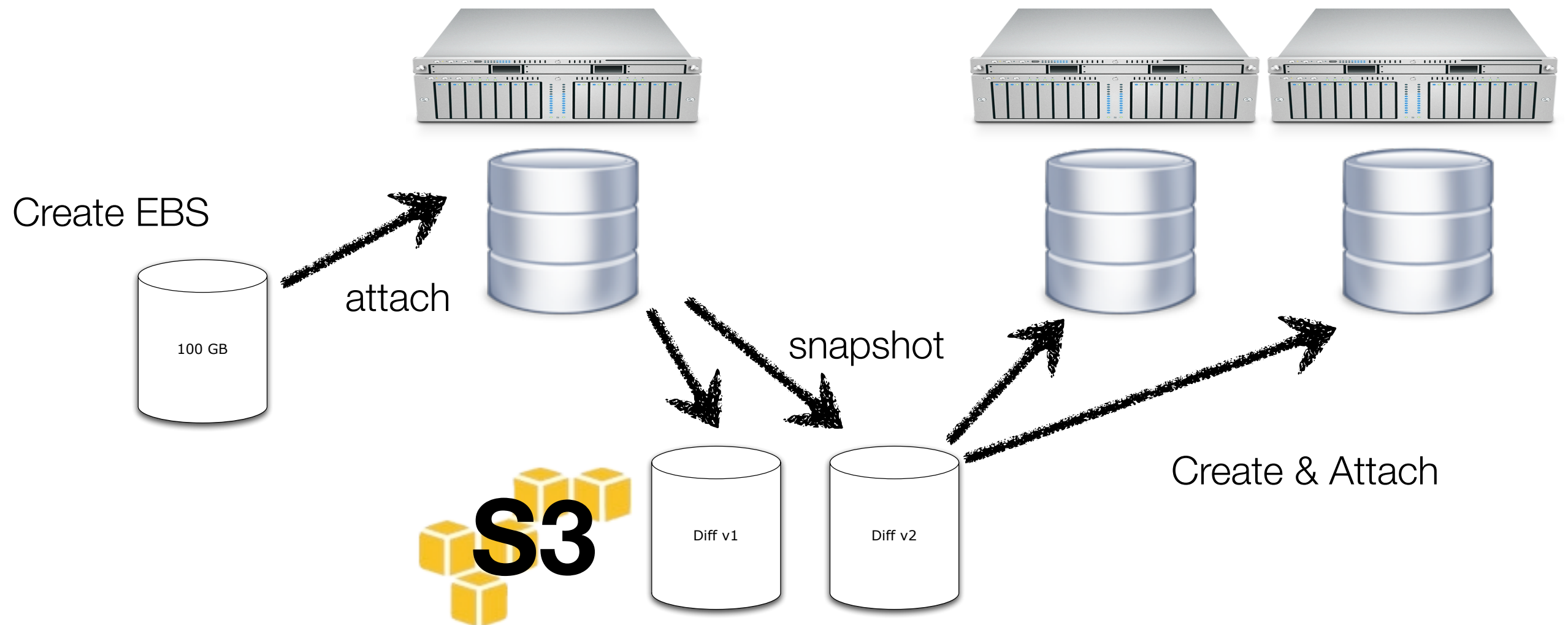
Elastic Block Store - EBS



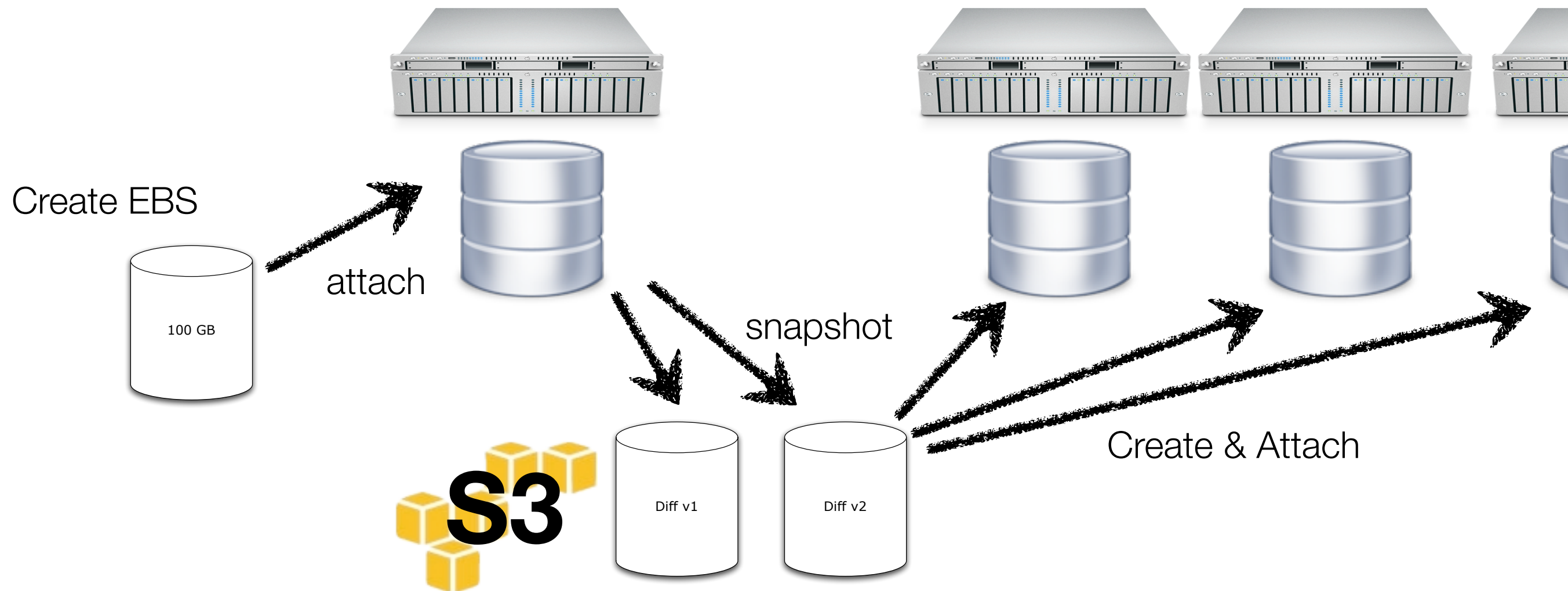
Elastic Block Store - EBS



Elastic Block Store - EBS



Elastic Block Store - EBS



Public Datasets

[Home](#) > [...](#) > [By Category](#) > [Geographic](#)

Public Data Sets on AWS

2008 TIGER/Line Shapefiles

 [Printer Friendly](#)  [Save to del.icio.us](#)

Census 2000 and Current United States shapefiles

Submitted By:	devseed
US Snapshot ID (Linux/Unix):	snap-00fb0869
Size:	125 GB
Creation Date:	04/24/2009
Last Updated:	04/24/2009
License:	Other
Source:	http://www.census.gov/geo/www/tiger/tgrshp2008/tgrshp2008.html

[Discussion](#)[Reviews](#)

This data set is a complete set of Census 2000 and Current shapefiles for American states, counties, subdivisions, districts, places, and areas. The data is available as shapefiles suitable for use in GIS, along with their associated metadata. The official source of this data is the US Census Bureau, Geography Division.

Reviews

[Write a Review](#)

Be the first to [review this](#).

Additional Benefits

- Federation
- Tile generation
- Content-delivery System
- Simple Queue System (SQS)

S3 Storage

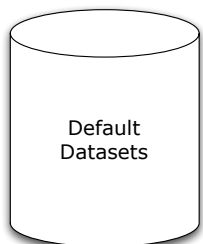


tiles/openstreetmap/9/74/97.png
tiles/openstreetmap/9/74/98.png
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tiles/bluemarble/9/74/98.png



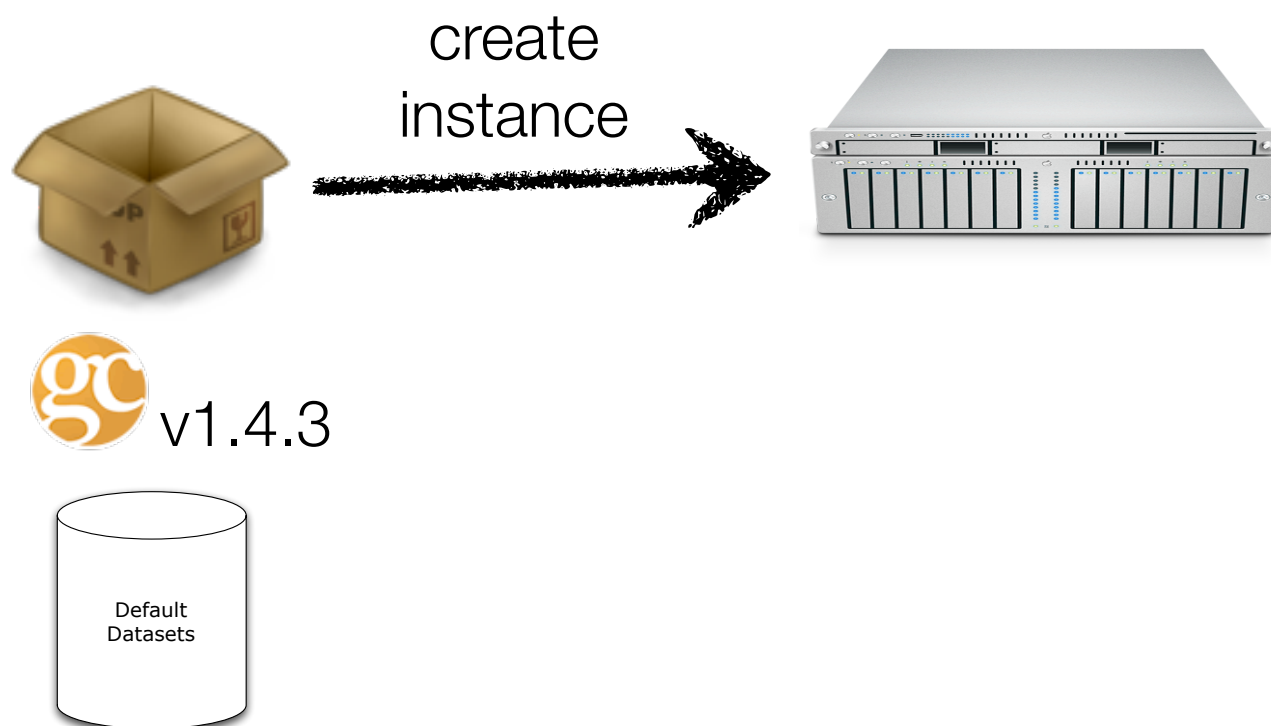
Cloud Architecture

- EC2 image of current system architecture
- EBS image stored to S3 of default database
- Current application release in S3
- Start an EC2, attach data, attach code, startup



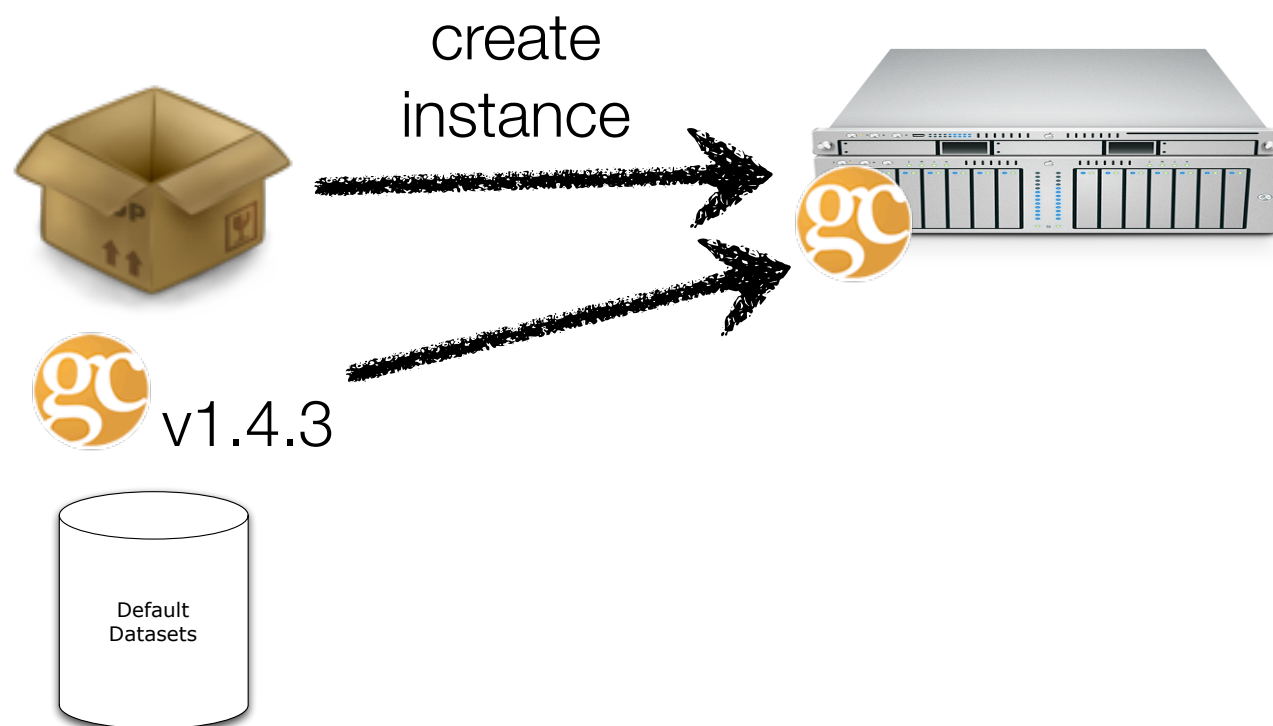
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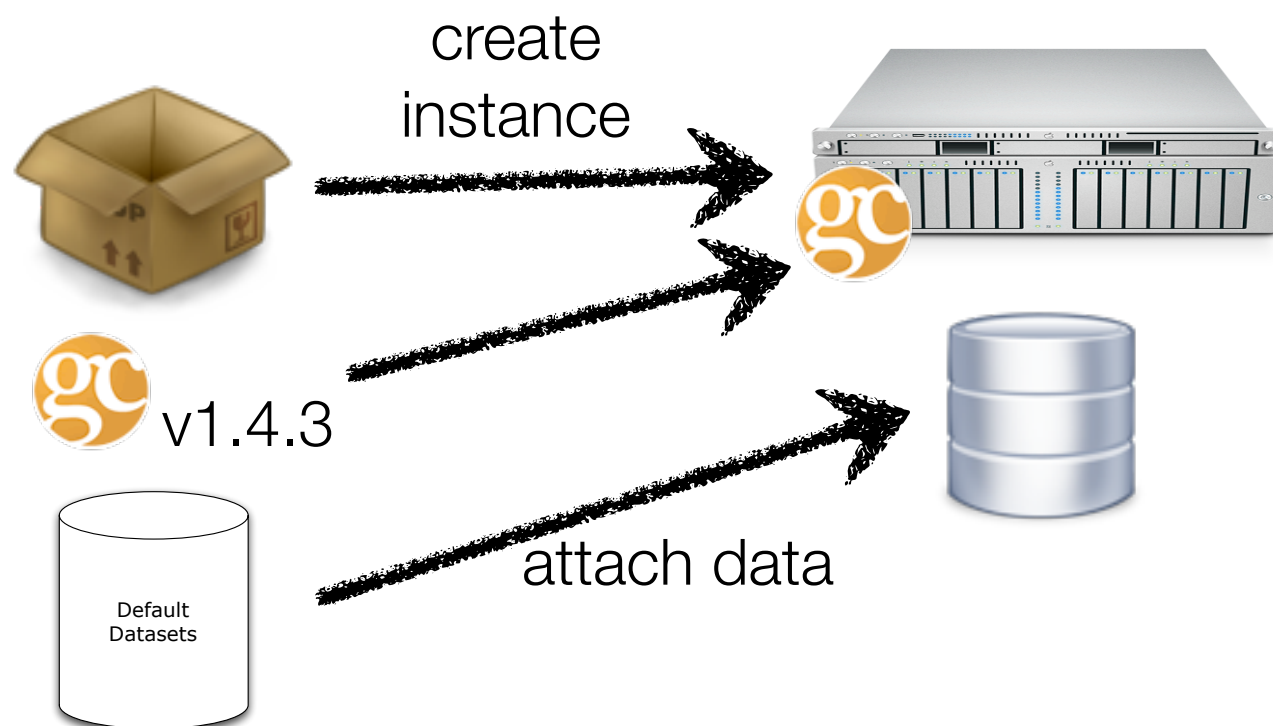
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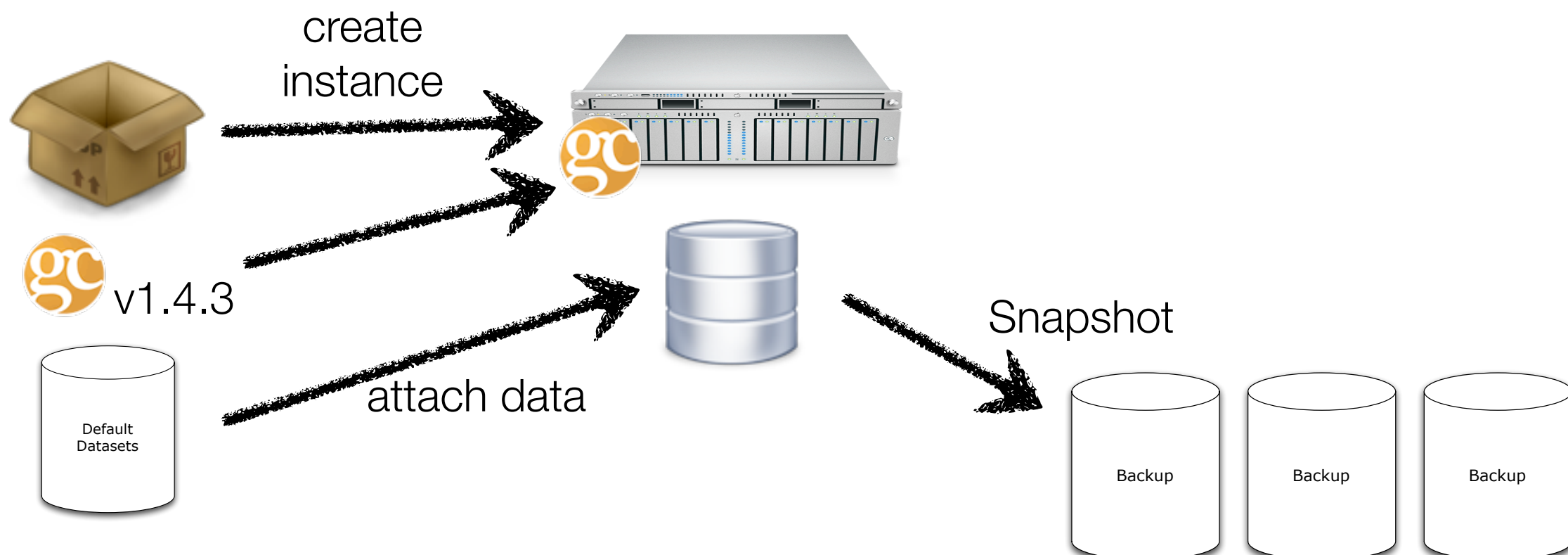
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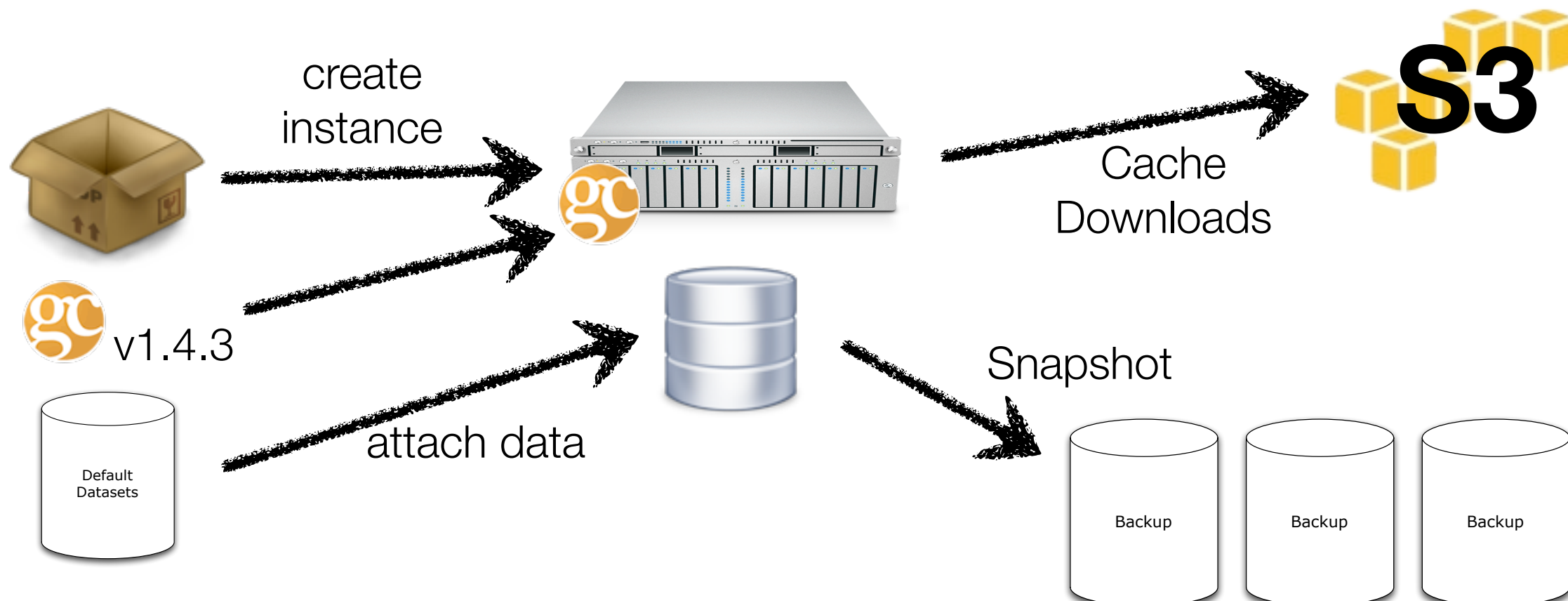
Cloud Architecture

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- EBS image stored to S3 of default database
- Current application release in S3
- Start an EC2, attach data, attach code, startup



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Scaling

- RESTful architecture
- Caching for speed, and CDN support
- Amazon Web Services
 - CloudWatch
 - Elastic Scaling
 - Load Balancer

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- ### Get Started
- [▶ Create a Map with Maker!](#)
 - [▶ Explore GeoData with Finder!](#)
 - [▶ Explore Current Events with Map of the News](#)

Finder!

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Upload, organize and share your Geographic Data.



Quickly find data you need with easy search tools.
Manage your own data using tags and then share your work with everyone.



Common Formats
Upload, download, and convert between Shapefile, CSV, and KML. Talk about handy and easy!

Technology Partners




DATAxSTREAM


Maker!

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We've made it easy to make compelling interactive maps.



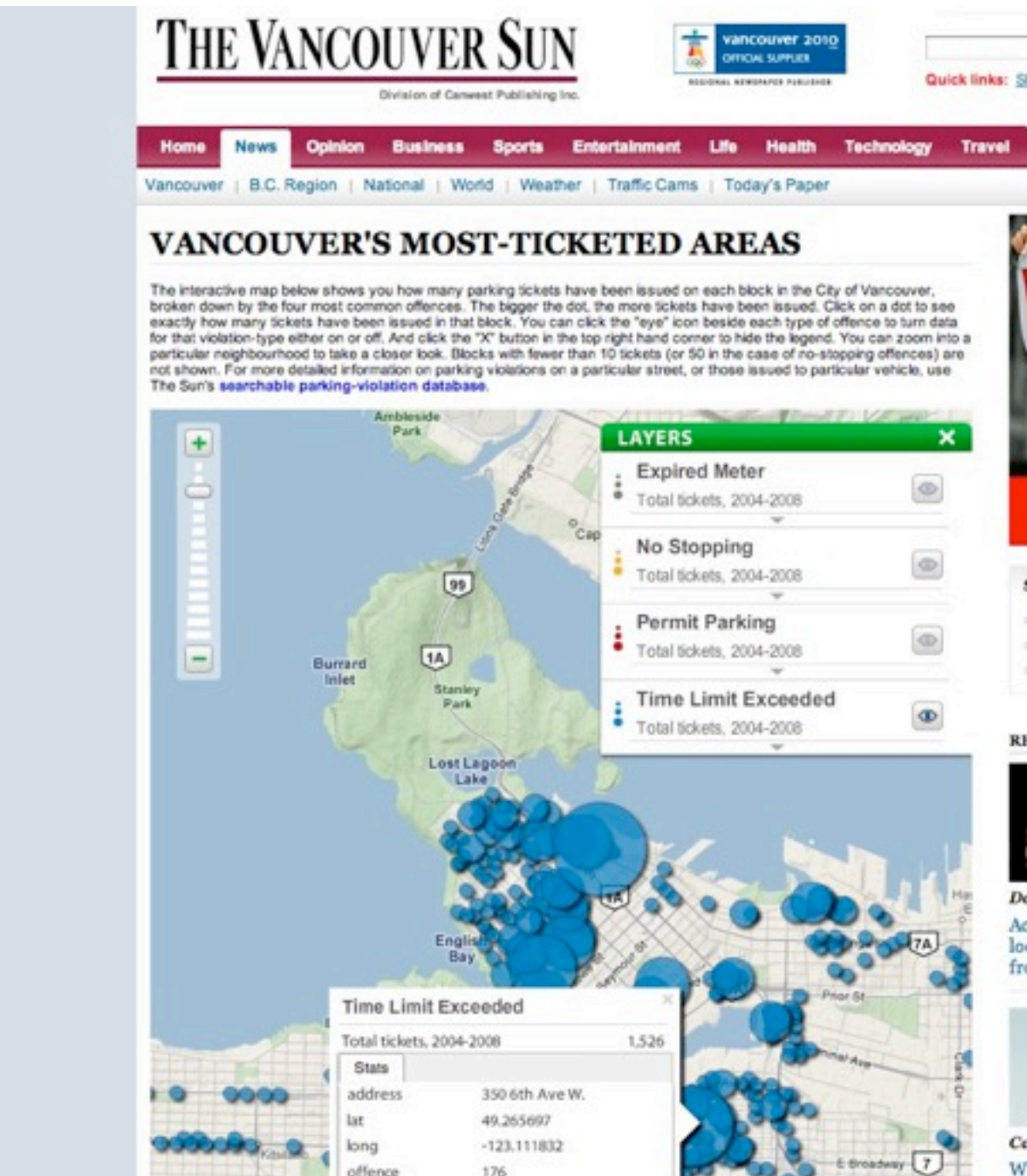
Actionable Maps in Minutes
From data to map in under five minutes. Maker streamlines GIS' best features into a quick and



Bust the Content Ceiling
Maker! can get more points, lines, and polygons onto a single map than any javascript map on the

Private Instances

First Users: Meedan, Media



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popular maps: 1, 2, 3, 4, 5, 6

comments from united arab emirates

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'Arab governments must be united in face of Israeli assault on Gaza'

Middle East response to Gaza conflict has not been clear, says Fahmy Huweidi

5 COMMENTS 3 PEOPLE

Gun battles rage in Gaza City as Hamas fighters battle Israeli troops

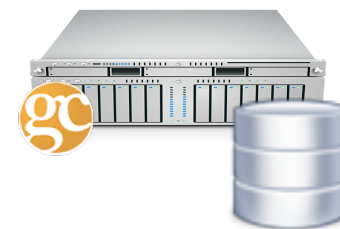
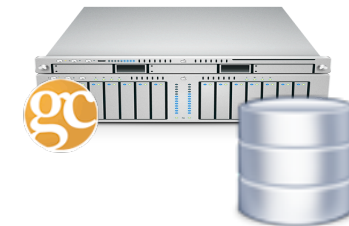
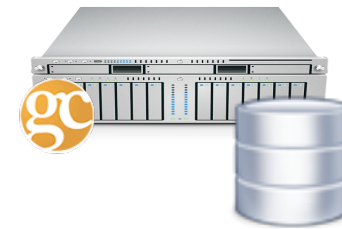
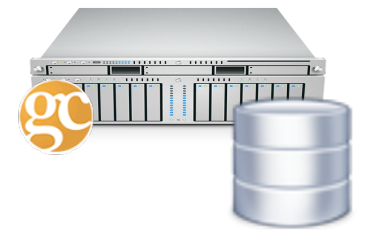
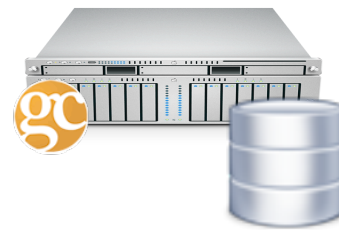
Hamas fighters clashed with Israeli troops in Gaza City Monday morning as invading IDF soldiers conducted house to house searches

Daphne Bramham
Accused polygamist looking for legal aid from B.C.

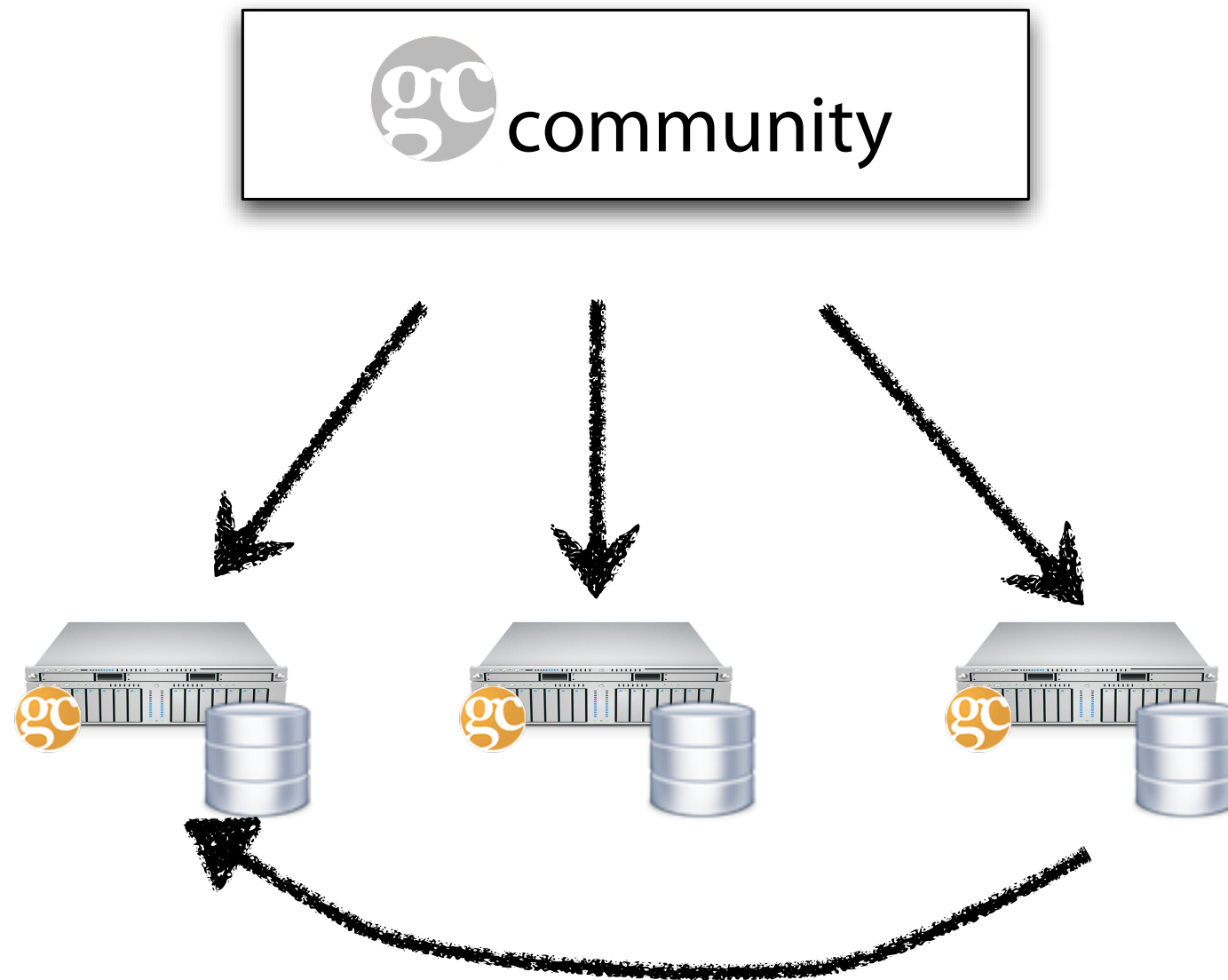
Cam Cole
When less Tiger may

Repeatable

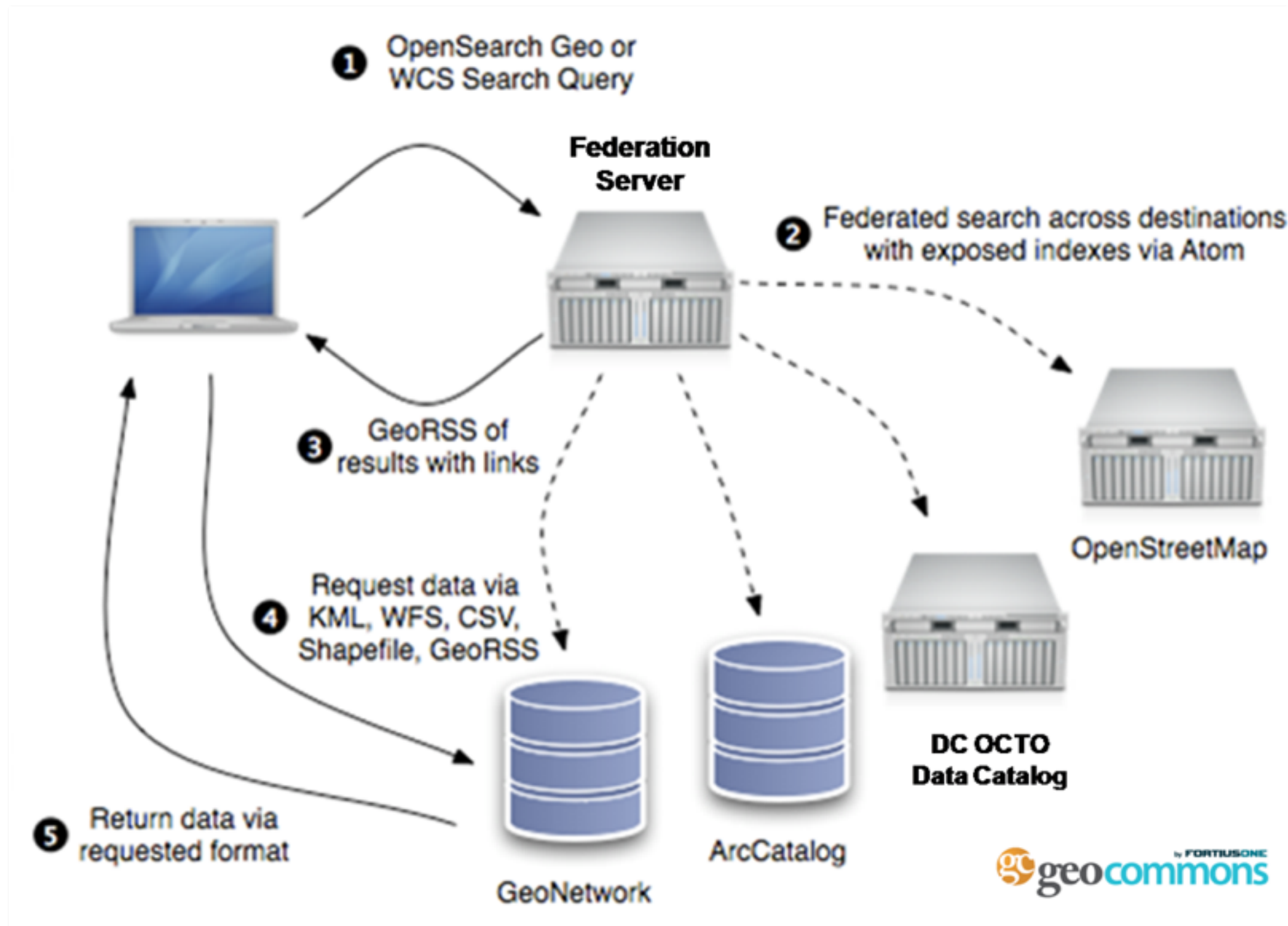
Repeatable



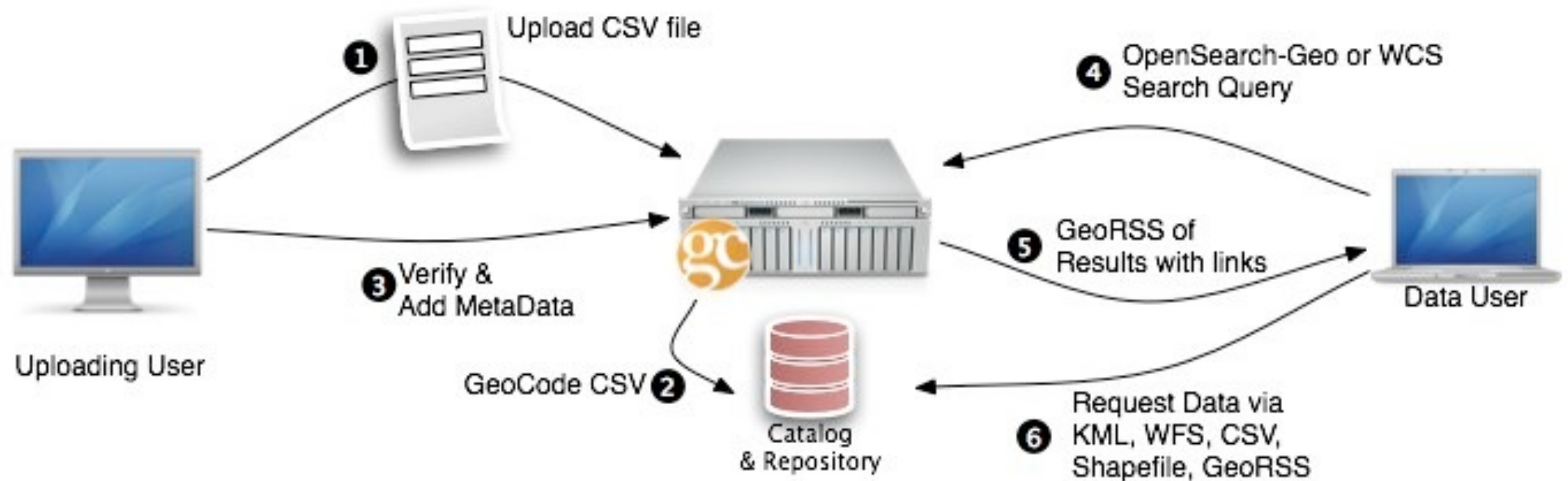
Data Federation



Geospatial Federated Search Search

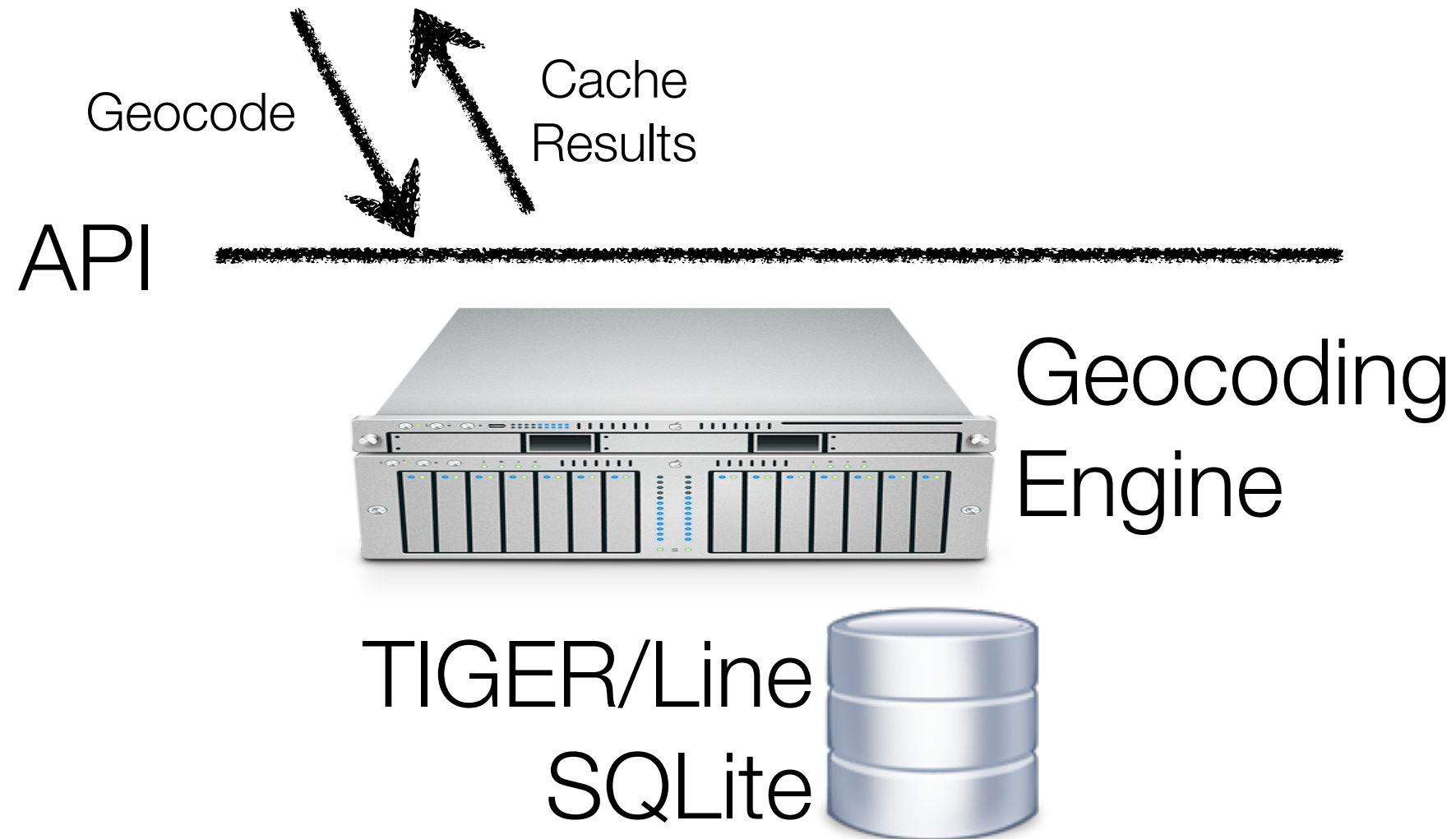


Geocoding

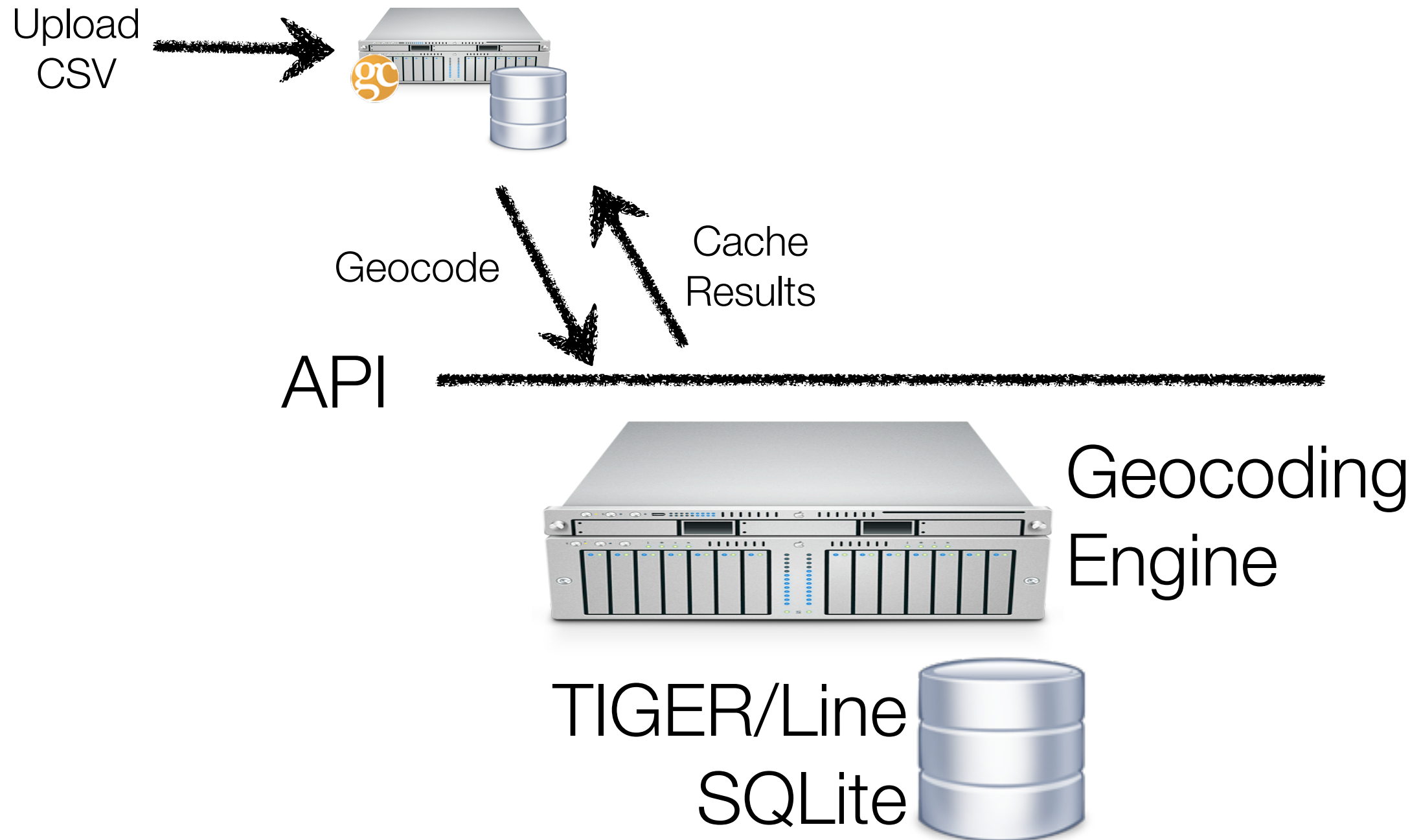


Geocoding - Scale as Required

Upload
CSV →



Geocoding - Scale as Required



Best Practices Applied to the Government

- Built using open, established tools
- Full choice - Linux, Windows
- Full Control
- Repeatable processes
- Continual backup
- Scaling dynamic and large datasets
- Synchronous and Asynchronous analysis

Level of Maturity

- Widely adopted
- Broad support and ecosystem
- Full stack support

Perceived Impediments to Adoption

- Single Vendor (open-source alternatives arising)
- Maintenance and Location
- Data Security

Thank you



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<http://highearthorbit.com/presentations>